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(A SYMPOSIUM OF SHORT PAPERS)

The final session for the consideration of papers presented to Congress was held in the Music Hall, Aberdeen, on the morning of Friday, September 11th, 1953, when the chair was taken by the President-Elect, Mr. Alexander Thomson, M.R.C.V.S., of Glasgow, who presided over a large attendance. The Recording Secretary was Mr. J. Suttie, M.R.C.V.S., of Forres.

No. 5.—SOME ASPECTS OF RESEARCH WORK AT THE POULTRY RESEARCH CENTRE, EDINBURGH

BY

J. G. CAMPBELL, PH.D. (EDIN.), F.R.C.V.S.

A.R.C. POULTRY RESEARCH CENTRE, EDINBURGH

The CHAIRMAN: Ladies and gentlemen, we started this Congress with an aperitif in the form of films by Dr. Spreull, and we are finishing it with what one might call a mixed grill. Time is short and I am going to call on Dr. Campbell, who is working at the A.R.C. Poultry Research Centre in Edinburgh. He is going to deal with some aspects of research work at this poultry centre. There are no official openers and I hope you will join quickly in the discussion if you have any comments to make.

Dr. CAMPBELL: Mr. Chairman, ladies and gentlemen, I find myself with rather a difficult task this morning because I am in the position of having to deputise for Dr. Greenwood, the Director of the Poultry Research Centre in Edinburgh. He is now in North America on a lecture tour with the result that I was asked to draw up some sort of paper in his absence. You will understand that my work at the P.R.C. is very much an isolated piece of work and I am not really *au fait* with all that goes on in other departments. Therefore, I hope to crave your indulgence in sparing me any profound questions about other people's research work. I shall endeavour to answer anything that crops up, but I know you will appreciate the situation.

The Poultry Research Centre in Edinburgh was first visualised in 1947, when the Agricultural Research Council of Great Britain proposed that a centre should be established for the investigation of certain fundamental problems associated with poultry. In 1950 the building was ready for occupation, and the staff, then only about four or five people, moved in. The staff has, of course, since increased considerably in size.

The purpose of the Poultry Research Centre was to investigate fundamental problems concerning poultry, which means that the fowl was visualised as being primarily an experimental animal and, secondarily, as an animal of commercial importance. The idea was that there should be basic research in a number of different disciplines—as, for example, in breeding, nutrition, physiology, endocrinology, biochemistry, and pathology.

Since the centre has opened, most of these departments have started functioning; the only one which has not done so as yet is the department of pathology. A pathologist is already appointed, but he is still undergoing post-graduate training in the laboratories of one of the big hospitals in London.

The Poultry Research Centre was lucky right from the start in two important aspects. One was the site of the building. The University of Edinburgh was kind enough to grant us a site situated just outside the city. The laboratory, therefore, is in juxtaposition to the Institute of Animal Genetics, the Department of Zoology, and the Department of Chemistry, and several other Departments, with the result that the staff have considerable advantages in being able to collaborate in many cases quite closely with various people in these other departments.

Secondly, a very important point was that the experimental material did not have to be built up. It was already there. Dr. Greenwood had been at the Institute of Animal Genetics for many years and during that time—since about 1931—he developed the now well-known flock of Brown Leghorn fowls. Starting with a small group of birds and introducing no fresh blood, he has developed a flock of inbred fowls. There are now about 1,600 birds. The great scientific advantage is that careful records have been kept ever since the flock commenced and the ancestry of any one particular bird can be traced back to 1931 or 1932, if necessary.

During this period of in-breeding no real disadvantages have come to light. On the contrary, an interesting thing has happened—at least eight different lines of fowls have been developed, all stemming from the original Brown Leghorns. They can be described as the breeding pen line, which are the birds commonly used for propagating the flock; the intensity line, an extremely good egg-producing bird; the large egg strain; the small egg strain, and the non-moult, which do in fact moult but at irregular intervals. Then there are the dwarfs and the whites. If anyone wants to see a white Brown Leghorn we can show them a lot. There is also the red-breasted strain, which is self explanatory.

Each strain has its own peculiarities, and from my own point of view two are particularly interesting, but I will tell you about that presently.

The great advantage of the strains is that they have developed over these past 20 years a considerable degree of genetic stability, so making them useful for research purposes. Also, we are able to provide research centres all over Britain with birds, knowing more or less what sort of results are going to be got with them especially in cancer work.

Very briefly, as regards the outline and the set-up of the P.R.C., it consists of two separate blocks of buildings. One comprises the laboratories and administrative offices, and the other one is composed of the animal houses, food stores, and so on. Actually, there are a few laboratories over in the animal house block. We keep birds in special

rooms for pathology and physiology and there are also hot rooms for climatic studies.

As I have said, the flock at present consists of roughly 1,600 birds and large numbers of chicks. The total staff of the P.R.C. at the moment is about 44 people, which includes 14 scientists, two of whom are visiting from South Africa. Then there are guest laboratories, used by visiting scientists from other Universities, especially in the U.S.A.

At the P.R.C. the research programmes of the various departments when examined all have a bearing on egg production. That is, after all, the main point of any research into poultry at all—how to get the maximum number of eggs and yet keep the bird a physiologically healthy animal.

These various research projects include artificial insemination, in the course of which Mr. Lake has found resistance of the fowl sperm to storage and to cold. However, when the sperm is taken from the animal by artificial means, it frequently happens that owing to the peculiar structure of the copulatory organs there is quite often a spasmodic contraction of the urethra with an expulsion of urine material, and it has been found that this is detrimental to the viability of the sperm. Mr. Lake is trying to find some method of preventing this urine contamination and is also studying some other difficulties concerning penetration and fertilisation of the ovum. The physiology of laying is being studied by Mr. Sykes.

Then there is an animal behaviourist. Many people smile at the thought of an animal behaviourist, but Mr. Wood-Gush is doing some most interesting work on mating behaviour and its relation to fertility.

Dr. Blyth is working on the components of the reproduction cycle. Mr. Miller is studying the biological value of proteins, particularly the effect of vitamin B_{12} on the utilisation of protein of animal origin. That has not been published yet. Dr. Bolton has been working on oestrogens. That work is finished and the findings are published, so what you have seen in print to-day is a little out of date. He has now taken up certain studies on carbohydrate metabolism and manganese metabolism. Dr. Greenwood and Mr. Hutchinson are investigating the reactions of fowls kept in hot, humid climates comparable with the tropics, with controlled lighting, controlled heating and controlled humidity. Last, but by no means least, are the genetic studies. Dr. Greenwood and others are continuing their long-term research in this direction. For a newly established centre I think you will agree that all this amounts to a fairly considerable programme of work.

The pathology section, which is not yet really functioning, has got a lot of work ahead of it. The diseases that we hope to study in the P.R.C. flock are what might be called non-specific diseases. One of the most important of these is nephritis. It is not strictly comparable to the mammalian nephritis and there is some suspicion that it has a genetic basis. Pathological studies of nephritis are urgently needed, though there have been some attempts in the past. Other non-specific diseases include peritonitis, always very important in fowls, and cannibalism. There are many theories as to what is the cause of the latter, but none really bears close examination and we are hoping that the pathologist will be able to do something about it in collaboration with the nutrition section.

I hope you will excuse me if I go into rather more detail about the work I happen to be doing with two colleagues. I should first explain that the British Empire Cancer Campaign, through the kindness and courtesy of the Agricultural Research Council, has been given facilities to develop a small unit at the P.R.C. We are working entirely with fowls, of course, and, as you probably know, tumourous conditions in fowls, among which we include all the leucotic conditions, are responsible for a great loss each year. The British Empire Cancer Campaign section has three main research problems at the moment. Dr. Carr, who is at present in France on a year's medical Fellowship, has been working on the electron microscopy of the Rous sarcoma virus. This highly malignant tumour of the fowl was discovered in 1910 and since has been propagated in laboratories throughout the world, and the amount of cancer research that has been done on it has been absolutely colossal. It would be an almost impossible task to collate all the papers that have been published on it.

Drs. Carr and Bather are working on the isolation and purification of Rous sarcoma virus by both physical and chemical means. They are studying the multiplication of the virus and the problem of cellular and humoral immunity, or resistance with increasing age, and the problem of natural immunity.

One of the interesting things found fairly recently is that after injection of live virus into healthy fowls the virus promptly disappears from the system and one cannot demonstrate it by any known means for at least 60 hours after injection. This is of course quite a well-known phenomenon with many other viruses, but it is particularly interesting from the point of view of cancer research. What appears to happen is that the virus penetrates the cells and undergoes some sort of life cycle, divides into units which are non-infective, and then multiplies to form infectious units which stimulate and transform the cells to malignancy. There appear to be two main factors concerned with the rate of virus multiplication. One is the rate of cell multiplication and the other is the age of the host. Another leucotic condition being studied is erythroleukaemia, a malignant blood condition of birds also associated with virus. Here again we find that a number of birds are turning out to be naturally immune and we are working on that and trying to find out if this immunity is genetic, whether it can be transferred, and so on.

Rather interesting results have come out of it. We have birds which are immune even after repeated challenge with colossal dosage, yet they remain perfectly healthy with no change in their blood picture. But if you take blood from these birds and inject it into susceptible birds the latter die of leukaemia, so that they must be acting as carriers.

Since I drew up this paper something has occurred which has rather set us back a little and will obviously need a good deal of further investigation. We have developed a small flock of these immune birds, and we have had two years of hatching so far. We find there is a high mortality rate in the young chicks hatched from the leukaemia-resistant birds and that some of these young chicks are dying of leukaemia at the age of six or eight weeks, which is much earlier than natural cases of leukaemia occur. It therefore seems probable that the virus is being transferred through the eggs of these so-called resistant birds.

This has happened only in the last few weeks, but it does look like an interesting complication.

Finally, we are working on a rather different aspect of ragwort poisoning. I will give just a few words of explanation on how this particular research came into being. Of course, you are all familiar with ragwort poisoning in

cattle. You may not have seen cases, but it is well known in literature. It is the cause of cirrhosis of the liver some time after the consumption of varying quantities of ragwort. There came to our notice some time back information regarding the extremely high incidence of liver cancer. Berman drew attention to this in his monograph, and showed that of all the forms of cancer in the young Bantu male in South Africa liver cancer occurred to the extent of 80 to 90 per cent. That figure is colossal compared with the incidence in this country and the States, where primary cancer of the liver is comparatively rare. He speculated on all sorts of reasons for this, but one of the things he missed was the fact that these people from early in life drink large quantities of ragwort infusion as a medicine and tonic.

It occurred to us that possibly as ragwort was known to be associated with liver cirrhosis, a condition usually a preliminary of liver cancer, the matter might bear further investigation. Therefore one of the things we are doing is collecting large quantities of ragwort, extracting alkaloids and testing them out. The results so far have been extremely interesting and will be published at a later date, but briefly, half the birds kept on the LD/50 level for some little period develop the most interesting histological changes in their livers, and it seems fairly hopeful that these birds, if we keep them long enough, may develop liver cancer. They show a tremendous proliferation of bile ducts and all the classic signs of incipient malignancy.

I have been out of the country for over a year so the work was rather interrupted. Prior to that I was only able to get small yields of alkaloids but now we are working on a large scale and have a satisfactory amount of material.

That really outlines the work that is going on at the P.R.C. Again I must apologise for spending more time on the work with which I am familiar, but I hope you understand the situation that I am not really capable of commenting on other people's work, not as competently as the Director would have been, anyway. Thank you very much. (Applause.)

Following is the text of Dr. Campbell's paper:—

It is difficult in the short time at my disposal to give an adequate account of the history and function of the Poultry Research Centre at Edinburgh, even though it has only been in existence on paper since 1947, and in actual fact since 1950. Briefly, the Agricultural Research Council of Great Britain decided in 1947 to establish a research organisation dealing wholly with poultry, and confining its activities to problems associated with breeding, nutrition, physiology, endocrinology, biochemistry and animal behaviour. In addition, a pathological section was visualised to investigate the non-specific diseases commonly affecting poultry.

From the beginning it was agreed that the function of the Centre was to perform fundamental research; in other words, the fowl was to be treated as an experimental animal first, and as a commercially valuable animal second. With this policy always in view, a research team of workers with training and experience in the fundamental sciences has been formed in order to investigate poultry problems by means of rigid scientific principles.

The Centre has been fortunate in many ways. The generosity of the University of Edinburgh in providing a site at King's Buildings means that the staff are in close proximity to other scientific groups, especially the Institute of Animal Genetics, and the Chemistry and Zoology Departments. Secondly, the material for research was already in existence in the form of the flock of Brown Leghorns which has been maintained at the Institute of Animal Genetics by Dr. Greenwood, without introduction of outside blood, since 1931. The history of this flock shows that inbreeding in no way alters the problems which confront the poultry industry in general. Detailed records of all these birds over a lengthy period make the P.R.C. flock an invaluable one for scientific research, providing various lines with a considerable uniformity of genetic stability, which are in constant demand by many research institutes throughout the country.

The Centre consists of two separate buildings, namely, a main laboratory block and a series of conjoined animal houses, incubator rooms, brooder rooms, grain stores and experimental rooms. The intensive accommodation provided houses 1,600 adult birds, and in addition a large number of young chicks are maintained for experimental purposes. At the moment the total staff number 44, of whom 14 are professional scientists, plus two post-graduate students from South Africa. It is planned to increase the professional staff considerably as time goes on.

Research in progress now covers a number of fields, all at first sight widely different, but in actuality all bearing on the various aspects of egg production. In the limited time it is not possible to do more than indicate the nature of the investigations under way. These include fundamental problems associated with artificial insemination, oviduct physiology, mating behaviour and fertility, variations in the components of the egg production cycle, the biological value of proteins, the relationship between oestrogen and riboflavin metabolism in the laying hen, the physiological acclimatisation of fowls to hot humid climates, and genetical studies on age at sexual maturity and inheritance of egg weight.

The pathology section is not yet fully established, but the programme will be an investigation of non-infectious diseases in the P.R.C. flock which cause an 11 per cent. mortality annually. Losses are mainly due to weaknesses in different organs and systems, and the tendency for certain pathological conditions to be associated with certain of the highly inbred lines leads to the supposition that they have a hereditary basis.

I hope I may be forgiven for mentioning more about the particular branch in which two colleagues and myself are working, namely, cancer research. Through the courtesy of the Agricultural Research Council, generous facilities have been provided to form a cancer unit under the *aegis* of the British Empire Cancer Campaign. We are therefore not members of the staff at the Centre, and you will thus understand my diffidence in accepting the invitation to give this paper in place of the Director, Dr. Greenwood, who is at present in North America. However, the work of the B.E.C.C. unit has a direct bearing on that major disease problem of poultry, namely, neoplastic disease in all its manifestations.

Several lines of cancer research are being pursued, whose nature I will try to summarise. The first is a study of the Rous sarcoma virus, and includes a programme of isolation and purification of the virus by physical and chemical methods, with an investigation into the mode of multiplication in the body of the host, together with the problem of cellular and humoral resistance with increasing

age. A line of fowls which shows a tendency to natural immunity is being developed, and the progeny are being tested. It is interesting to note that this line also shows some resistance to chemically induced tumours, although of course no infective agent or virus has so far been demonstrated in such tumours. It has been found that following infection with the Rous virus, it loses its identity as such for 60 hours or so, probably by division into smaller sub-units, and that multiplication takes place at this stage. The particles later re-unite to give more infective virus at about the time that malignant transformation of the infected cell is detectable under the microscope. Two factors control the rate of virus multiplication, namely (a) the rate of cell multiplication and (b) the age of the host.

Secondly, a good deal of work is going on with erythroleukaemia, part of the leucotic complex of disease in chickens. This is also virus-associated, and, as with the Rous sarcoma, a line of resistant fowls has been started, and the progeny tested for immunity. The first tested generation showed a 65 per cent. resistance to the leukaemia virus after inoculation with several thousand infective doses. This is to be compared with the normal survival rate of around 10 per cent. which six-week-old chicks from the rest of the flock show after similar treatment. These experiments are continuing. The two forms of resistance to Rous sarcoma and erythroleukaemia seem quite independent, antibodies to one virus conferring no protection against the other, and *vice versa*. The birds resistant to leukaemia virus, even after repeated challenge with very large infective doses, show a normal blood picture, but their plasma contains infective material which is lethal to normal fowls. The role of such "carriers" as a means of disseminating infection in flocks is being studied.

Thirdly, and finally, experiments are being conducted to test the carcinogenic effect on the liver of certain plant alkaloids of the *Compositae* family, particularly those of ragwort (*Senecio jacoboea* Linn.). The alkaloids are hepatotoxic in very small doses and are, of course, generally accepted as causing the well-known liver cirrhosis in farm livestock, associated with ragwort poisoning. It is of interest in this connection to notice that the Bantu tribes in South Africa drink quantities of ragwort infusions from an early age, and that they show a remarkably high incidence of liver cirrhosis and liver cancer in their twenties and thirties. From preliminary results it seems likely that the chicken and the duck will prove of considerable value in these investigations.

Summary

A brief account is given of the history of the recently developed Poultry Research Centre, Edinburgh. The general purpose of the investigations being carried out at the Centre is to derive knowledge of value towards the solution of problems affecting most aspects of the poultry industry. For this very wide approach, many branches of science are utilised, including genetics, physiology, biochemistry, pathology, and animal behaviour.

The Chairman: If you have any comments to make will you please make them quickly and make them brief. (Slight pause.) If there are no comments on Dr. Campbell's paper, I think we will move on to the next one. It seems there is a fair amount of fundamental research going on and we hope to hear more from that centre.

No. 6.—THE USE OF MONOZYGOUS TWINS IN EXPERIMENTS WITH CATTLE

BY

JOHN A. CRICHTON, M.B.E., M.A., B.Sc.

The Rowett Research Institute, Bucksburn, Aberdeenshire

The Chairman: The next paper is by Mr. Crichton and the subject is "The use of monozygous twins in experiments with cattle."

Mr. Crichton: Mr. Chairman, ladies and gentlemen, this morning I should like, first of all, to add a little more to what I have written on the identification of 1-egg twins because the supply of these rather rare and valuable experimental animals is short of our requirements even to-day when their usefulness has not yet been fully exploited. It may be possible that veterinarians working in the field would be able to keep a look-out for any twins that look like identicals. These could be reported to a collecting centre, thereby saving much time and trouble. At the present moment there are only two centres collecting on a large scale, one in Staffordshire and the other in Reading, but it may be necessary to start some others in areas where the cattle population is fairly dense.

Then I should like to illustrate the uniformity of behaviour of 1-egg twins and finally to describe in some more detail the plan of the experiment presently running at the Rowett Institute, which you are going to see this afternoon.

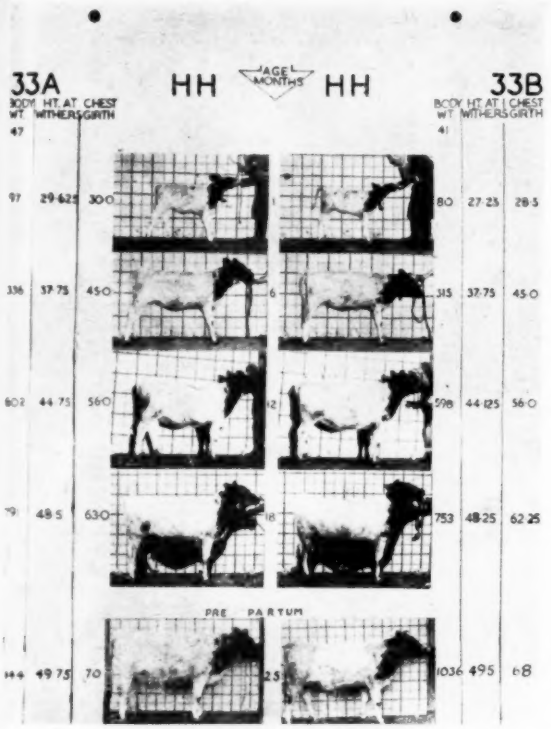
If 1-egg twins are to be used for growth or production experiments it is necessary to have them under controlled environmental conditions as soon as possible. This means identification shortly after birth, which is at the most difficult time. Hancock, of New Zealand, has emphasised the importance of examining calves for points of difference rather than for points of similarity. Two-egg twins may have many points of similarity, but when showing differences in any one of a number of critical points they may be eliminated at once from further consideration.

The more important criteria are: (1) the shape of the head—length, width, set of ears, shape of the eye arches and muzzle, etc.; (2) the hair colour which should be of the same density or shade although there may be considerable differences in the size of white hair spots; (3) skin pigmentation of the lips, the palate, the tongue and the lower jaw, the inside of the ear and the ano-vulva region. Sometimes unpigmented regions in these parts may vary in size but that is not very important; and (4) the general skeletal outline which is a very good pointer in indicating monozygosity.

Slides then shown, illustrating similarity in twins as regards appearance, physical conditions, milk production, etc. They included the following:—

SUMMARY OF DATA FROM A TWIN PAIR REARED UNDER IDENTICAL CONDITIONS (H H)

TWIN N°	CONSUMPTION OF T D N. BIRTH TO 72 WEEKS LB	GAIN IN WEIGHT BIRTH TO 72 WEEKS LB	LB TDN REQUIRED PER LB GAIN	GAIN ON GRASS 72 TO 91 WEEKS LB	FOOD CONSUMPTION DURING LACTATION TDN LB GRAZING DAYS
33A	3469	747	4 64	205	2121 | 203
33B	3387	721	4 69	198	2119 | 203
	TOTAL MILK YIELD LB	TOTAL BUTTERFAT YIELD LB	AVERAGE PERCENTAGE BUTTERFAT	LENGTH OF LACTATION DAYS	4 PERCENT FAT CORRECTED MILK LB
33A	7671	286	3 70	313	7358
33B	7698	285	3·70	313	7360



Mr. Crichton concluded: I hope I shall be able to demonstrate this afternoon much more clearly what I have been trying to put over this morning. Thank you very much. (Applause.)

Mr. Crichton's paper was as follows:—

In a small percentage of cattle the zygote in various stages of development may divide to form two individuals. Since the twins thus produced arise from a single egg they are known as 1-egg or monozygous in contrast to the more normal 2-egg or dizygous twins. The term "identical" is perhaps too precise a term, but normally refers to the genetic similarity of the two individuals as proved by their very similar anatomy, behaviour, appearance and other biological characteristics.

From 1916 onwards various workers suggested that 1-egg twins existed in cattle, but their occurrence was not finally established until 1932 when Kronacher, in Germany, reported the results of a study of 35 pairs of like-sexed twins and concluded that several were 1-egg. Although Kronacher and his associates did not use such twins for planned experiments they made the valuable contribution that 1-egg twins are produced in appreciable numbers in cattle, and developed methods for their identification. Professor G. Bonnier, of the Animal Breeding Institute at Wiad, in Sweden, was the first to demonstrate their value as experimental animals, and from 1937 onwards collected numbers of pairs which were used to investigate many important subjects. During the last 10 years several hundreds of pairs have been identified in New Zealand (Ruakura Animal Research Station) and in the United Kingdom (Animal Breeding Research Organisation), while collections are being made in many other parts of the world.

Although there is no absolute certainty, nevertheless a reasonable degree of accuracy in identification of 1-egg twins is possible, even at a very early age. This is of great importance since animals to be used for experiment must be maintained under controlled environmental conditions as soon as possible. When like-sexed twins are born they are submitted to a critical examination of all visible characteristics. Hancock, of the Ruakura Station, New Zealand, uses a variation of the "similarity" method originated by investigators of human twins where the method of diagnosis was based on the degree of similarity of physical features followed by confirmatory tests mainly on finger and palm patterns. He, however, takes particular note of the points of differences in order to answer his question, "Are the differences of such kind and are they sufficiently small to justify the assumption that the twins are identical?" He maintains that correct diagnosis depends mainly on the elimination of 2-egg twins. The normal characteristics usually examined are shape of head, hair colour, body conformation, muzzle, ear and udder pigmentations and hair whorls.

The technique of using 1-egg twins has been one of the most significant developments in cattle research within recent years. There is no doubt that the reason for the small number of worthwhile feeding trials with cattle carried out in the past has been the lack of suitable experimental animals. This applies especially to feeding experiments on the production of dairy cattle since the groups of cows in an experiment on any one station can seldom be large enough to compensate for their inherent or genetic variability in milk yield. Because of the identical genetic constitution of 1-egg twins it is possible to measure more accurately the effect of various treatments, separate and distinct from the genetic effect, and with much fewer animals.

One-egg twins may prove to be of great value in endocrine research. For example, the capacity for milk secretion is believed to be governed by the rate of secretion of hormones which stimulate udder growth, the secretion of milk into the alveoli and its subsequent "let down" through the teats. The effect of administration of one or more of these hormones may vary with the level of production of the endogenous hormone. By the use of 1-egg twins varying in productive ability the effect of supplementary hormonal treatment in relation to inherited productive ability could be measured. Male twins are being used with success in studying the factors influencing sexual maturity, fertility, semen production and other related problems. The study of climatic influences, the factors affecting the composition of milk and the solution of many problems in beef production will be aided by the use of 1-egg twins. How far twins can be used in investigations on resistance to disease has not been studied, so far as I am aware, but they may be valuable material for this purpose.

While 1-egg twins are exceedingly useful experimental animals, they have their disadvantages. Various figures have been given for the frequency of 1-egg twinning, but if the assumed frequency of one pair per 2,000 births is accepted the number discovered will be much smaller, and if other conditions are imposed, *e.g.*, breed, milking capacity, type, etc., then the number of suitable animals may be very small. This means that the cost of their collection is proportionately increased. Losses of twins will be at least twice the normal rate, since if one of a pair is lost the other is usually useless. Marked differences in the date of conception within pairs is a common cause of

loss. The carrying of replacements and even the temporary housing of a discarded animal means extra housing and accommodation, which is further taxed when pairs have to be reared under identical environmental conditions to the age of production before they can be put on experiment.

How uniform are 1-egg twins reared under similar conditions? This question is very important since their value in research depends upon the extent to which they behave similarly when kept under uniform environmental conditions except for the experimental difference being studied. Uniformity trials have been carried out in New Zealand on the following characteristics: production of milk, butter-fat and casein; growth; grazing behaviour; physiological and biochemical blood components; physiological reactions to high temperatures; immunological responses and sexual strength. Some characters show very little variability in within-twin sets, other characters show great variability. Under New Zealand conditions growth, milk and butter-fat production and grazing behaviour showed remarkably high uniformity in 1-egg twins. Extensive uniformity trials are being carried out in this country at the Animal Breeding Research Organisation of the Agricultural Research Council. The results will be of great value in British research.

At the Rowett Research Institute 1-egg twins are being used to study the effect of four different planes of nutrition during the rearing period (approximately two years) on the growth, yield and health of dairy cattle. In very general terms the four treatments covering the two years' rearing period are as follows: (1) High-high, (2) High-low, (3) Low-low, and (4) Low-high. During the high plane of nutrition the animals are fed 110 per cent. of the total digestible nutrients required for normal growth as laid down by Ragsdale, of Missouri, and during the low plane 60 per cent. of the same standard, but only during the winter months when the animals are stall-fed. As it was decided to simulate normal farming practice as closely as possible, all animals go to grazing in summer, but we confine the low-plane groups to hill pasture while the high-plane groups are on good arable leys. The experiment started in the autumn of 1947, but owing to the long spread-over of the time of arrival of the pairs, the youngest animals are just completing their first lactation. Some interesting observations have, however, already been recorded.

Summary

The history of the discovery and use of 1-egg twins is sketched, and their advantages and disadvantages are discussed briefly. The results of uniformity trials have shown that in the study of certain characteristics, *e.g.*, growth, milk and butter-fat production, 1-egg twins are highly efficient. Wastage among experimental twins may be high and more accommodation may be necessary than for unrelated animals.

Discussion

The Chairman then invited questions on the paper.

Dr. W. S. Gordon (Compton): Mr. Crichton should be congratulated on an admirable presentation of the results he had obtained in comparing the characteristics and performances of 1-egg twins. He had mentioned that 1-egg twins appeared to be very friendly disposed towards each other. Was that friendliness greater to a significant degree in 1-egg twins than in 2-egg twins reared together?

Mr. Crichton: The answer was Yes. One-egg twins appeared from observations made to be much more friendly (if that was the correct word) than 2-egg twins, though one sometimes got the impression that 2-egg twins were more friendly than non-related animals. When the low-plane animals were separated from the others at the beginning of the grazing season they broke loose and within 12 hours had found their mates 2 miles away and were discovered each in company with her own twin sister.

Two-egg twins also showed some similarities. When Dr. Donald's work was published it might be shown that 2-egg twins were a very valuable kind of experimental animal. They were much more easily obtained than 1-egg twins.

A Member: Had Mr. Crichton experience of one of a set of 1-egg twins becoming infected with a disease and affecting the performance of the other?

Mr. Crichton: The only experience he had had of a set of twins becoming affected by disease was a case of nymphomania. One had turned nymphomaniac and her mate on a lower plane of nutrition had turned nymphomaniac about six months later. He had had no other experience of disease.

Mr. G. N. Gould (Southampton): As regards the fertility rate of various groups of heifers, how were the heifers that had been referred to served? Was service given by the same bull, or was there any comparison, such as the conception rate of an A.I. centre?

Mr. Crichton: A 1-egg bull had been obtained. (It was thought that a twin bull from a 1-egg pair should be used to see if there was any effect on subsequent twinning.) The bull was used entirely for serving the experimental animals and a high rate of fertility resulted. A.I. had not been used. The rate of fertility had been compared with that of the main herd of the Institute and it was much higher. The main herd conception rate to first service was in the region of 40 per cent. —but was about 90 per cent. in the case of the twins. This was probably because of the employment of the young unused bull referred to which was kept solely for use on the heifers concerned.

Mr. Gould: There was apparently no comparison of the conception rate with a standard such as that of an A.I. centre. In such small groups of animals the rates referred to might be somewhat misleading.

Mr. Crichton: Results with other animals, using the same bull, were known.

Dr. R. F. Montgomerie (Beckenham): Mr. Crichton had pointed out the marked differences in the dates of conception of pairs. In view of the very great similarity in characteristics that was surprising. Would Mr. Crichton agree that it was rather peculiar to have such marked differences in the dates of conception, in view of the great tendency to common behaviour? Could he elaborate at all on what was contained in the paper and explain this rather surprising feature?

Mr. Crichton: In New Zealand, where large numbers of identical twins were used, they had lost, through marked differences in the calving dates, quite a lot of experimental animals. It should not be implied that there were greater differences in the dates of conception in identical twins than in any other cattle. Perhaps in New Zealand there had been some disease factors which caused the differences.

Dr. Montgomerie: With Mr. Crichton's experience had this marked difference begun to make itself manifest?

Mr. Crichton: No. His own experience had been fortunate. Only one or two pairs had been lost through a marked difference in conception.

A Member: Was there any method of identifying these twins by their position in the uterus from time to time? Was there a difference in the foetal membranes between them and the 2-egg twins?

Mr. Crichton: He believed 1-egg twins were usually in the same foetal membranes, but with no experience on the matter he did not want to answer the question.

Mr. A. Pottie (Paisley): Had anybody else noticed that the first heat at 12 months was very late, because seven months was commoner in practice? It was rather strange to have first heat at 12 months and it would be interesting if Mr. Crichton could say if there was any difference regarding the first heat of different breeds.

Mr. Crichton: The average time was at 12 months but the earliest was at eight months. Very few of his calves were pure-bred—they were all crossbred except for two or three pairs—and he could not therefore answer the question about breeding.

A study had been made of birth weights and while the length of gestation made a difference of about 1·6 lb. a day, different planes of nutrition appeared to have no effect on the weight of calves at birth.

No. 7.—MUSCULAR DYSTROPHY

BY

K. L. BLAXTER, D.Sc., PH.D., N.D.A.

Hannah Dairy Research Institute, Kirkhill, Ayr

The Chairman: I will now call on Dr. Blaxter to give us his paper on Muscular Dystrophy.

Dr. Blaxter: I should first of all like to thank the B.V.A. for their very kind invitation to me to speak to you to-day and to describe some of the work we have been doing on muscular dystrophy.

We first became interested in muscular dystrophy some four years ago as a result of experimental studies with Ayrshire cattle. We produced the disease experimentally; we showed we could prevent it with vitamin E administration, and we showed a great deal, too, regarding the biogenesis of the lesion. At first we did not think it to be of great importance. We thought it a very interesting academic matter, but we soon realised that we were wrong because it now appears quite certain that muscular dystrophy must be regarded as a major disease, particularly in certain of the beef rearing areas of Scotland.

Following is the text of the paper:

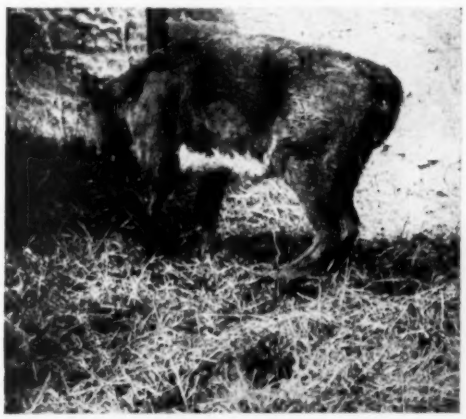
Diseases of the muscular system are comparatively rare in human and veterinary medicine. A condition in cattle, however, variously known as "leg illness," "transport disease," "heart rheumatism," "white muscle disease," "fish flesh" or "hen flesh," has been recognised for many years on the Continent, notably in the northern part of Germany and in the Scandinavian countries (see Blaxter & Brown, 1952-53, for review). In these countries records of this muscular disease go back to the latter half of the 19th century. In Scotland a similar disease has evidently been extant for a period of at least 50 years. The causes of these muscle diseases which were suggested by earlier workers have been remarkable for their diversity. An infectious agent (Nieberle, 1926), dietary deficiency of vitamin C (Hjärre & Lilleengen, 1936), or of certain members of the B complex (Seifried, 1943), and a sequel to acute or chronic inflammation of the abomasum (hair-ball) (N.V.M.A. Report, 1947), have all been suggested as causes of the disease. During the course of recent work at the Hannah Institute, we have produced the disease experimentally in several ways (Blaxter, Watts & Wood, 1951, 1952), and it appears quite certain that both the experimentally produced disease and the enzootic muscular dystrophy encountered in beef rearing herds in Scotland involve a gross interference with vitamin E metabolism.

The clinical signs of the experimental disease have been described elsewhere and are indistinguishable from those encountered in the field, as Mr. Sharman will point out later. Figs. 1 and 2 show typical cases. The present paper is concerned with some remarks on the pathology of the condition and its aetiology.

The salient pathological feature of the carcases of calves which have died as a result of muscular dystrophy is the presence in the muscles, including the cardiac muscle and diaphragm, of widespread areas of degeneration. In the skeletal musculature these areas are conspicuous by their bilateral symmetry. Affected muscles tend to be oedematous, are whitish cream in colour and have lost the resilience characteristic of normal muscle. Small areas of haemorrhage may also be present. Figs. 3 and 4 illustrate these changes in experimental cases.

From histological examination, the sequence of events leading to this terminal condition may be inferred. The primary change appears to be the hyaline degeneration of individual muscle cells. Commonly a single fibre may contain several hyaline swellings, whereas its neighbouring cells appear normal. Coagulation of the sarcoplasm and necrosis follows the hyaline degeneration, although on some occasions vacuole formation may be observed. Collapse of the sarcolemmal tube appears to initiate a spectacular proliferation of the nuclei of the sarcolemma, such that in very severe lesions sections reveal little but a mass of proliferating nuclei. The lesion is non-inflammatory and there is very little cellular infiltration of any sort (MacDonald, Blaxter, Watts & Wood, 1952). Figs. 5 and 6 illustrate two stages in the development of the lesion.

Biochemical investigation shows quite clearly that there is a loss of the contractile proteins and the myoglobins of the muscle cell, together with a reduction in the content of creatine and creatine phosphate. Furthermore, the potassium of the muscle cell is lost, and there is an infiltration of sodium. The lipids of the muscle and the characteristic proteins of the connective tissues are not reduced in quantity, but there is an increase in the nucleoprotein content (Blaxter & Wood, 1952).

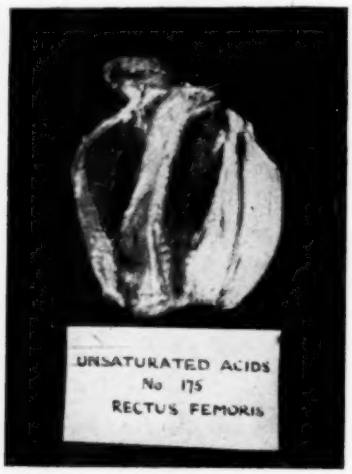


Figs. 1 and 2.—Field cases of muscular dystrophy.

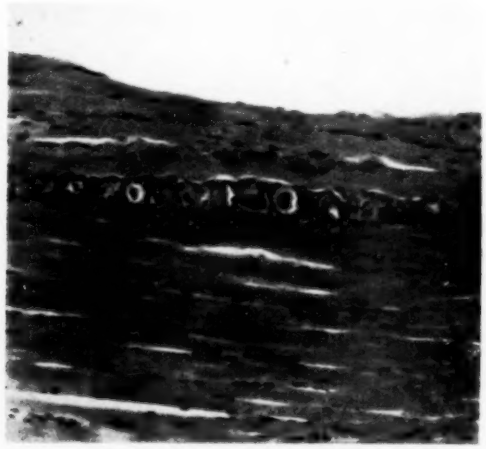
Our experimental work has shown that the disease can be produced by feeding to calves rations which are almost free of vitamin E. Under these conditions the disease develops in a period ranging from 20 to 70 days, the main determinant being the reserves of vitamin E which the calf possesses. We have also shown that the inclusion of cod-liver oil in the rations of calves leads to a striking increase in the requirement of vitamin E (Blaxter, Wood & MacDonald, 1953), and that the use of recommended amounts of cod-liver oil in conjunction with rations low in vitamin E content, such as dried skim milk powder, results in very severe muscular dystrophy. This toxic effect of cod-liver oil we have shown, further, to be very closely associated with its content of unsaturated fatty acids, and tentatively we are of the opinion that the presence of polyethenoid acids is the specific factor responsible (Blaxter, Brown & MacDonald, 1953b). The extent of the toxicity may be judged by the fact that calves must ingest 40 to 80 mg. α-tocopherol daily to neutralise the toxicity of only 10 ml. cod-liver oil, whereas in the absence of cod-liver oil, the requirement of the vitamin is less than 5 mg. daily.

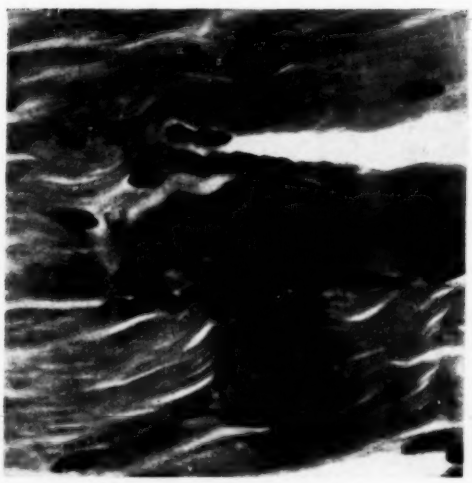
Many cases of muscular dystrophy in beef and, to a lesser extent, dairy cattle, have come to our notice through the courtesy of the Veterinary Investigation Officers in Scotland and of farming organisations. Cod-liver oil poisoning is involved in many, but cod-liver oil toxicity does not account for the large incidence of the disease, tentatively placed at 7 per cent. of all rearing farms, which Mr. Sharman and I have encountered in the Inverness area. Experiments which have just been completed, however, show without any doubt that the muscular dystrophy on these farms may be prevented by giving the cow vitamin E before she calves and subsequently supplying the calf with an additional amount. Again, field results show that provided diagnosis is made sufficiently early, oral administration of α-tocopherol acetate will effect a cure.

The cause of the naturally occurring disease in Inverness is closely associated with the poor quality of the



Figs. 3 and 4.—Affected musculature of experimental cases of muscular dystrophy.





Figs. 5 and 6.—Histological appearance of dystrophic musculature showing the focal nature of the lesions and the proliferation of the sarcolemmal nuclei.

ration given during pregnancy to the dams of the calves, together with the fact that in these single suckled herds, the calf receives no source of vitamin E activity other than its dam's milk for several months. Analysis by methods we have developed (Brown & Blaxter, 1951; Brown, 1952a, b) has shown that the vitamin E content of swedes, mangolds and fodder beet is 0·5 to 1·2 mg. per 100 g. dry matter, while oat straw contains approximately the same concentration (Brown, 1953). In contrast to these, we have shown that the vitamin E content of fresh grass is 30 to 40 mg. per 100 g. dry matter, a value which is but little depressed by the process of ensilage. In this regard, it is of interest that information obtained from the field indicates that the disease does not occur on farms which have been in the habit of making good-quality silage. A low vitamin E intake is reflected in the level of the tocopherol content of the blood serum. Thus, immediately before calving the blood serum of these cows receiving poor quality rations contains only some 50 to 90 μg. total tocopherol per 100 ml. At the Hannah Institute farm we have found values at least 10 times as high. Similarly, the blood vitamin E content of calves suckling these dams contained as little as 5 to 20 μg. vitamin E per 100 ml., whereas calves from dams which have been adequately fed contained 200 to 400 μg. per 100 ml. Milk and colostral tocopherols are also decidedly lower in cattle given rations low in vitamin E.

It would appear, therefore, that the long winter period, during which cows are housed and given rations consisting of large quantities of turnips and oat straw, is sufficient to result in a serious depletion of body reserves of vitamin E. Little is yet known, however, of the time relationships involved in this depletion, save that the disease is more prevalent following long winters than short. Since we have shown that a major part of the vitamin E reserves of the calf is acquired during pregnancy (Blaxter, Brown & MacDonald, 1953a), and since the content of vitamin E in the milk and colostrum of the cow is very sensitive to dietary change, it would appear that these depleted cows give rise to calves which have very small reserves. Generally some potentiating factor is necessary to produce the disease. The trauma of exercise on turning calves out in the springtime may be sufficient to precipitate serious muscle abnormalities and with cardiac cases the mere excitement of suckling may be sufficient to result in death. Other potentiating factors may also be present.

Muscular dystrophy of calves must therefore be added to the list of diseases of cattle which are of nutritional origin. Heretofore vitamin deficiencies in cattle in Britain have been regarded as of very rare occurrence. Thus vitamin A deficiency has been recorded in this country on only a very small number of occasions; most of the recorded cases of vitamin D deficiency are probably due to mineral deficiency or excess, while ruminants, by virtue of the synthetic activity of their rumenal flora, are independent of a dietary source of members of the B complex. The present results suggest that deficiency diseases involving vitamin E are of greater significance than we had realised in the past.

I take this opportunity to acknowledge the co-operation in this work of Dr. F. Brown and Dr. W. A. Wood, of the Nutrition Department, Hannah Dairy Research Institute, of Dr. A. M. MacDonald, of the Royal Hospital for Sick Children, Yorkhill, Glasgow, and of our technical staffs.

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Discussion

The Chairman then invited comments and questions.

Mr. I. S. Beattie (Edinburgh): On the question of regeneration of affected muscle following treatment with vitamin E, had Dr. Blaxter followed the process and, if so, had he any remarks to make on it?

Dr. Blaxter: Very little work had been done by him on the regeneration of muscles, but one seemed to get extremely interesting changes such as rowing of muscle nuclei and an enhanced Feulgen reaction. Provided the degeneration had not gone too far, muscle would regenerate. In a later stage there was severe calcification of the lesion and once the disease had reached this stage it was difficult to obtain remissions. But in the early stages, provided there was a quick diagnosis, one could get a complete cure.

Mr. G. A. M. Sharman (North of Scotland College of Agriculture) then read the following contribution, illustrated by slides:—

I have been asked to describe more fully the naturally occurring disease in Scotland. I can speak only for North Scotland.

In Inverness and the Moray Firth area it is one of the greatest, if not *the* greatest, causes of loss in beef calves. One practising veterinary surgeon has been good enough to abstract figures from his books and he has shown that in the last three years 33 per cent. of the beef calf rearing farms in his practice have had cases of the disease. Of these, 3 per cent. were affected three out of three years, 16 per cent. two out of three years and 14 per cent. one out of three years. Incidence on individual farms can be anything at all, from one case up to 100 per cent. incidence—recorded in one herd of 23 pedigree Aberdeen Angus cows, with their 23 calves. The disease occurs when calves born indoors first go to grass. Mortality depends on the type which the disease assumes. In the cardiac type the mortality is high.

Three types of disease are recognised in the field. By far the commonest is the type associated with muscular dystrophy of the skeletal muscles. The commonest form shows extreme shoulder stiffness with shoulder blades projecting above the line of the back and a gait in which forelimbs are carried out and forward, the line of the forearm never coming back beyond the vertical.

Other forms of stiffness are: complete inability to rise; stiffness of the neck; stiffness of the hind limbs. Stiffness is always bi-laterally symmetrical.

The second is the cardiac type. Here death is extremely sudden. It follows exertion, usually that of suckling. An important point of differential diagnostic value from hypomagnesaemia of the calf is the extreme rapidity of death. It will all be over in a minute or two. After suckling the calf will stand back, breathe extremely rapidly, fall over in a coma and die. Death from hypomagnesaemia will take at least five minutes.

The third is the diaphragmatic type—fast breathing and normal temperature.

Before cattle go to grass, blood tocopherol levels of dams and calves are of great assistance in making a diagnosis.

It is a disease of in-wintered suckler cattle. In the north area cows are housed in October or early November and are fed on straw and turnips until calving, which takes place from December to May. They thrive well on this diet and produce big strong calves. Oats and hay may or may not be introduced at calving time. The calves as a rule receive nothing but their dam's milk.

Most cases occur in the week after calves go to grass. Cases do occur before this, however, especially cases of the cardiac type, and fresh cases occur outside up to four weeks after going to grass, particularly after a night of cold east wind.

Dr. Blaxter and I have carried out a field experiment to show that the disease can be prevented by ensuring that cows and calves receive sufficient vitamin E and Dr. Blaxter has shown that the straw and turnip winter ration fed to cows is deficient in vitamin E. We took 164 cows on 20 farms which had been affected in previous years and fed large quantities of α tocopherol to 82 of them during the month prior to calving. We subdivided the calves born to these cows, giving α tocopherol to half of them from birth until they went to grass so that we had four groups of 41. The results were as follows:—

Muscular Dystrophy: 164 Cows Under Experiment

82 α tocopherol		82 no α tocopherol	
41 calves α tocopherol	41 calves no α tocopherol	41 calves α tocopherol	41 calves no α tocopherol
Cases	Cases	Cases	Cases
nil	2 doubtful	3 definite*	9 definite 2 doubtful

* Diagnosed in first three days of life before administration of α tocopherol to calves.

Treatment of field cases has this year been most satisfactory. The dosage used has erred on the generous side. We can confidently state that an early skeletal case will respond to initial dosing by mouth with 600 mg. α tocopherol acetate followed by 200 mg. once daily until symptoms recede.

Mr. E. J. Hughes (Birmingham): Dr. Blaxter and Mr. Sharman were to be complimented on a very thorough job of work. (Applause.) Obviously there must be loose ends, but there were not many as far as one could see. There were two questions he wanted to ask. Was there any myoglobinuria and was there any suggestion that there might be a "familiar" incidence? Both these factors occurred in some of the dystrophies in man. The practical problems here needed some thought.

It was clear that experimentally the "cod-liver oil" disease could be easily produced, but to what extent did cod-liver oil feeding play a part in the cases Mr. Sharman had talked about? Because quite obviously the diet of the cow had a considerable part to play. How many of the farms in which the disease occurred frequently were feeding cod-liver oil?

At the end of Dr. Blaxter's paper he advised that vitamin A deficiency was not really a problem in this country. Was that really so? Six years previously it would have been said that vitamin E deficiency was not a problem in this country either. They were caught between two fires on this. There was evidence that there was some vitamin A deficiency, and they had got to decide how to avoid that. Of course, one could not give cod-liver oil in order to avoid vitamin E deficiency, but what was going to be done about vitamin A deficiency, because it could not be ignored?

Dr. Blaxter: The disease in man was somewhat different. In the first place, it was not exactly the same histologically. It might be the same in the initial stages but it certainly was not in the late stages. Myoglobinuria was experienced in a small proportion of cases, especially where the disease was severe. One of the things which took place in the degenerated muscle was a loss of muscle haemoglobin.

With regard to "familiar" incidence, he did not know the answer. It was known that it occurred in some beef herds and not in others. This was probably due to a nutritional fault on the farm rather than to a genetic cause.

No cod-liver oil was given on any of the farms in the Inverness experiment. There had been in Inverness in the last six months or so quite a number of cases where cod-liver oil was a factor in producing muscular disease, but in the 20 or so farms included in the experiments no cod-liver oil had been given.

The point at issue with regard to cod-liver oil was this: If one added it to a diet that was on the borderline of requirement with regard to vitamin E one would get muscular dystrophy. With older animals the danger was not so great. The danger was particularly great with the young, newborn animal. So far as feeding calves with adequate vitamin A was concerned, there were plenty of reliable preparations on the market at the moment. There were concentrates of vitamin A and D available which were highly satisfactory, and the longer they could keep away from cod-liver oil the safer they would be.

Dr. W. S. Gordon (Compton): He wished to join Mr. Hughes in congratulating Dr. Blaxter on a very excellent piece of work, thoroughly and ably done in a way such as they had come to expect from Dr. Blaxter.

Had Dr. Blaxter any ideas as to the cause of death in this disease? The rapidity of onset and rapidly fatal outcome was suggestive of death from a shock type of reaction. Had there been an opportunity of examining the blood in series from the onset of the disease until the time when death took place? Was there any evidence of an anhydraemia developing which became more marked as the animal approached death?

Dr. Blaxter: The actual and immediate causes of death were varied. Where dystrophy was of the respiratory type death was largely due to anoxia. In the incidence of the cardiac type the whole of the *post-mortem* picture was that which one would expect in a primary cardiac failure. He had not done anything further on the actual cause of death. In many instances it was thought that the animals died of a secondary infection. Thus, where there was very serious muscle degeneration of the throat muscle, the tongue and facial muscles, inhalation pneumonia was common. There was no anhydraemia. In actual fact there was a marked tendency towards an oedema of the muscle associated with a loss of potassium from the muscle cell and an infiltration of sodium.

Dr. Gordon: With oedema of the muscle he thought there might be an amount of fluid trapped out of circulation in the oedematous area.

Dr. Blaxter: "No, I do not think so."

* * * * *

No. 8.—ANTIBIOTICS AS SUPPLEMENTS TO THE RATION OF FARM LIVESTOCK

BY

W. S. GORDON, C.B.E., M.R.C.V.S., F.R.S.E.

AND

J. H. TAYLOR, M.R.C.V.S.

Agricultural Research Council, Field Station, Compton, Berks

The Chairman: I shall now ask Dr. Gordon to present his paper.

Dr. Gordon: Mr. Chairman, ladies and gentlemen, we are in the fortunate position of being the last speakers on the last day with the last paper in a week of very strenuous days and nights, so brevity will be popular.

We undertook work to determine whether there was value in the addition of antibiotics to the type of diet commonly used in this country for feeding pigs from weaning to bacon weight and the paper now in your hands describes the results of that work which forms part of a combined trial carried out by several research establishments under the aegis of the Agricultural Research Council.

Dr. Gordon then showed lantern slides of the tables presented in the paper, amplified the results obtained and summed up by saying that from these results it may be

concluded that the addition of the antibiotics described, to the diets used, resulted in an increase in growth rate, and an improvement in the food conversion in the pigs on the supplemented diets. Further, comparison of the profit in rearing pigs from weaning to bacon weight showed that the addition of antibiotics to a diet could increase profits by from about 25 to 45 per cent.

We are still very interested in trying to find why antibiotics improve growth rate and food conversion, but no definite opinion has yet been formed. We have been sleuthing the antibiotics through the digestive tract and tissues of pigs on these diets and Mr. Taylor has much detailed information on this subject which he may have an opportunity of telling you about during the course of the discussion. That, I think, is all the time I wish to take on this subject.

The paper was as follows:—

Introduction

The historical literature on microbial antagonism and the way in which this phenomenon has been turned to advantage in the treatment of bacterial infections has been reviewed by Florey (1949)[1], and before turning to the subject of this paper it is salutary to pause and consider that as long ago as 1885 Cantani had tried to replace a harmful bacterium by a harmless one. This so-called replacement therapy, especially in the intestine with lactobacillus and *Bact. coli*, had the object of choosing as the new invader an organism which was the producer of substances antagonistic to the pathogen. Florey also refers to the work of Moro & Murath (1906) who found a powerful bacterial inhibitor in the stools of nurslings and attempts were made later to apply this knowledge in the treatment of acute and chronic diseases of the digestive tract in man.

Although it is now generally accepted that minute quantities of certain antibiotics added to the diet of various species of apparently healthy animals may increase the rate of growth and efficiency of food conversion, these substances were not originally added to the diet as a therapeutic but as a growth-promoting factor. It was first observed by Moore, Evenson, Luckey, McCoy, Elvehjem & Hart (1946)[2] that the feeding of streptomycin or sulphasuxidine to chicks resulted in acceleration of growth rate. In 1949, Stockstad, Jukes, Pierce, Page & Franklin[3] found that *Streptomyces aureofaciens* produced vitamin B_{12}, a vitamin closely associated with the "animal protein factor" and residues from the production of aureomycin were used as a source of this vitamin. It was found later that the feeding of such residues to chicks stimulated the growth rate to an extent greater than could be accounted for by feeding vitamin B_{12} alone. These observations were confirmed in other species and in 1950[4] even pure crystalline aureomycin hydrochloride was found to increase the growth rate of chicks fed on what was considered to be an adequate diet. The chick, turkey and young pig[5] have been shown to benefit from the feeding of various antibiotics and evidence is increasing to suggest that the calf benefits from an aureomycin supplement[6 7 8 9 10 11]. The goose[12] and duck[13] are possible exceptions.

The growth-promoting effect is limited in all species to the young rapidly growing animal[14 15 16 17 18] and appears to depend on a better utilisation of an adequate diet and not on a substitute for any part of the diet.

Further, if the antibiotic is withdrawn during the growing period the growth-stimulating effect is lost and opinions vary as to whether the benefit already obtained may be retained or lost.

An antibiotic usually produces a greater effect when it is used to supplement a diet of vegetable protein, and used in this way it may produce a growth rate that equals, or even exceeds, that produced by a diet containing animal protein. Although possibly less effective when used to supplement a diet containing animal protein this combination appears to produce the greatest growth response.

Environment may modify the response to an antibiotic supplement considerably and it has been shown that pigs kept under conditions of extreme cleanliness may show little or no response[20]. Similarly, while birds in a long-established poultry house may benefit, those in new buildings may not.[45] Under normal conditions, however, the feeding of antibiotics usually, but not invariably, produces an increase in growth rate and food conversion.[21]

Not all antibiotics are of equal value, but good results have been obtained from aureomycin, penicillin, terramycin and bacitracin. Results with streptomycin[22], streptothrycin[23] and polymyxin[24] are less conclusive, while chloramphenicol[25] and nisin[14 26] have no apparent effect. Growth stimulation has been reported on a wide range of levels and in the recent co-ordinated trials the amounts varied from 4·5 g. per ton to 224 g. per ton of procaine penicillin and from 9 g. per ton to 28·8 g. per ton of aureomycin[35], but the optimum level has yet to be ascertained under varying conditions and according to the species, age and diet. It is debatable as to whether any advantage may be gained from feeding a combination of antibiotics[22 54] but Barber, Braude & Mitchell (1953)[27] report that the improvement of growth rate and food utilisation in pigs resulting from aureomycin can be considerably enhanced by the addition of endocrine stimulants.

In October, 1951, the Agricultural Research Council called a meeting to decide whether the findings already obtained were sufficient to justify amendment of the Penicillin Act, 1947, which prohibits the use of antibiotics for all but medical or veterinary purposes. As British and American methods of pig feeding and management are often very different, it was felt that the limited British experience was insufficient to warrant a decision being taken about the advisability of allowing antibiotics to be included in pig food. The Council therefore decided to initiate further experiments to determine the effect of antibiotic supplements on the growth rate, efficiency of food conversion and carcase quality of fattening pigs. Experiments on suckling pigs were started at about the same time[35].

The purpose of this paper is to report the results of that part of the co-ordinated trial which was carried out at the Council's Field Station, Compton. The main part of the work was undertaken by one of us (J. H. T.) and it constitutes the first of a series of similar investigations at this station.

Materials and Methods

Husbandry

The experimental animals were selected from the self-contained herd of pedigree Large White pigs on this station, and were the progeny of one of two closely related boars. The pigs were housed in a Danish-type house in which conditions of environment and management were identical throughout. Pigs were fed twice daily with wet food, giving as much food per pen as could be eaten in half an hour at each feed.

Mixing of Rations and Antibiotics

The basic rations were mixed in 10-cwt. batches in a self-charging vertical mixer, and in the case of supplemented rations the supplements were dropped into the mixer from above while the machine was running. Two types of diet

based on those used by Robinson, Coey & Burnett (1952)[28], were used as shown in Table I.

Table I

Composition of Rations

Vegetable protein ration		Animal protein ration	
Ingredients	Per cent. composition	Ingredients	Per cent. composition
Ground nut meal (decorticated)	20	Ground nut meal (decorticated)	5
Bran	20	Bran	25
Maize meal	20	Maize meal	20
Barley meal	35	Barley meal	37
Dried grass meal ...	3	Dried grass meal ...	3
Calcium carbonate ...	1·5	White fish meal ...	10
Sodium chloride ...	0·5		
Estimated crude protein content 18·5 per cent.		Estimated crude protein content 18·5 per cent.	

That described as "vegetable protein" contained protein of vegetable origin only while that described as "animal protein" contained white fish meal as well as vegetable protein. Two antibiotics were chosen for the tests, aureomycin because this was used in most of the American trials, and penicillin because it is manufactured in quantity in the United Kingdom. Aureomycin was given as Aurofac 2A—the proprietary mixture containing aureomycin and some vitamin B_{12} made by Lederle Laboratories, Ltd., at a rate equivalent to 28·8 grammes of aureomycin hydrochloride per ton. Penicillin was given as pure procaine penicillin incorporated in a diluent and prepared by Glaxo Laboratories, Ltd., at a rate of 15·4 grammes of penicillin per ton. Vitamin B_{12} was added to all rations containing antibiotic at the rate of 15 mg. per ton. Each batch of supplemented food was sampled after mixing and its antibiotic content checked. Periodically throughout the storage period the level of antibiotic in the food was assessed and no significant loss of activity occurred during the storage period.

Records

Individual pig weights and pen food consumption were recorded weekly.

The following records were obtained :—

1. Growth rate. The average daily live weight gain in lb.
2. Conversion ratio. The pounds of food required to produce 1 lb. gain in live weight.
3. Carcase quality. Carcases were graded by both the Ministry of Food Educational Grade and the 1939 Contract Grade, and marks were allocated for 10 of the more important qualities examined.
4. Production costs. The pigs entered the experiment at the current market prices obtaining at the time, and the food consumed was charged at the purchase price. Labour costs were calculated and agree with accepted standards, Davidson (1949)[29]. Miscellaneous costs have been put at the accepted figure of 5 per cent. of gross output[30], and then distributed to each pen in proportion to the "pig days" in that pen. The total proceeds were derived from the value obtained for the pigs when killed for bacon. The cost of the antibiotic was not known and is excluded from these calculations.

Plan of Experiment

Pigs of approximately 40 lb. weight were randomised into pens of eight pigs each applying restraints on litter, sex and weight in that order, and the pigs were kept until they were approximately 210 lb. live weight, when they were killed and sent to a bacon factory.

The experiment was repeated three times in the course of a year and in each replicate there were six pens of eight pigs each. Thus the comparable pens in the first replicate were A1 to F1, the second replicate A2 to F2, and the third replicate A3 to F3 as shown in Table II.

Table II

Plan of Experiment

Pen	Replicate	Number of pigs in each group	Supplement added: Antibiotic	Supplement added: Quantity grammes per ton	Sex distribution: Male	Sex distribution: Female	Commencement of experiment: Mean age, days	Commencement of experiment: Mean weight, lb.
A§	1	8	None	—	4	4	70	41
	2	8			5	3	66 } 68·3	33 } 38·7
	3	8			4	4	69	42
B§	1	8	Aureomycin Hydrochloride	28·8	4	4	65	41
	2	8			4	4	74 } 69·3	35 } 39·3
	3	8			4	4	69	42
C§	1	8	Procaine Penicillin	15·4	3	5	71	45
	2	8			4	4	74 } 71·3	35 } 41·0
	3	8			5	3	69	43
D¶	1	8	None	—	4	4	71	42
	2	8			5	3	71 } 70·3	35 } 39·3
	3	8			5	4	69	39
E¶	1	8	Aureomycin Hydrochloride	28·8	4	4	71	48
	2	8			5	3	71 } 70·7	36 } 43·0
	3	8			4	4	70	45
F¶	1	8	Procaine Penicillin	15·4	4	4	68	40
	2	*7			5	2	66 } 68·0	35 } 39·3
	3	8			5	3	70	43

* One death due to pneumonia. Basic ration : § Vegetable protein ; ¶ Animal protein.

Results

The results are shown diagrammatically in Figs. 1, 2 and 3, and recorded in Tables III, IV and V.

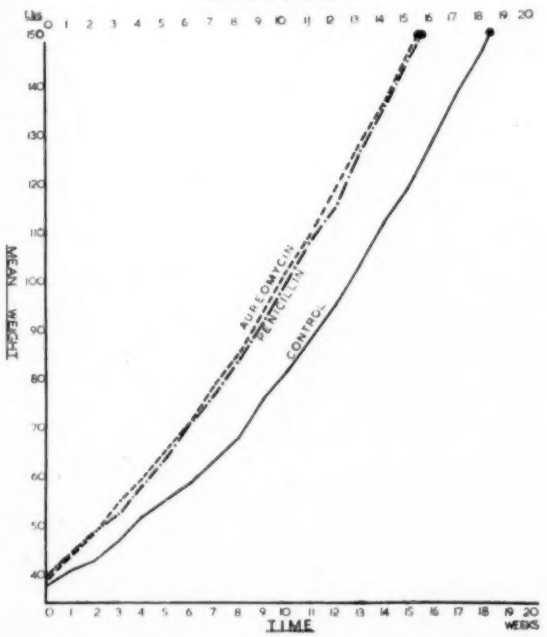
A consistent increase in growth rate for the supplemented diets based on vegetable protein is seen in Fig. 1, and on animal protein in Fig. 2, amounting to an average of about 10 per cent. increase over the control with penicillin on a vegetable protein diet and 12 per cent. on an animal protein diet, 15 per cent. with aureomycin on vegetable protein and 12 per cent. with aureomycin on an animal protein diet (Fig. 3). These increases bring the growth rate for vegetable protein up to or beyond the level set by an unsupplemented animal protein diet (Table III). An analysis of variance shows these increases to be significant with $P = 0{\cdot}001$ for the vegetable protein, and $P = 0{\cdot}01$ for the animal protein. No significance could be shown between the effect of one antibiotic and the other in either diet.

The food conversion ratio was decreased by either supplement (Table III) giving a saving of from 9 to 17 per cent. of food when the live weight had reached 100 lb., but had fallen to 5 to 11 per cent. when feeding was continued to bacon weight, average 210 lb. This difference in conversion ratio was significant ($P = 0{\cdot}05/0{\cdot}01$) but again differences between the effect of one antibiotic and the other on conversion ratio could not be shown.

The result for carcase assessment is recorded in Table IV, from which it will be seen that the variation between different groups appears to be haphazard and the difference between the two extreme groups is less than 6 per cent.

Calculated production costs for each treatment are recorded in Table V, and it can be seen that an increase of profit of from £1 to £1 16s. per pig has been calculated, representing an increase in profit of from 26 to 47 per cent. from which there falls to be deducted the cost per pig of the antibiotic supplement.

Fig. 1
GROWTH RATES
VEGETABLE PROTEIN



Discussion

These results bear a fairly close correlation to the mean increase in growth rate obtained in the co-ordinated trials, but the reduction in conversion ratio on an animal protein diet is somewhat greater than the average values recorded at other centres[35].

It has been estimated that 85 per cent. of the present cost of pig production is attributable to feeding-stuffs[29 30], and therefore it is clear that a reduction in the conversion ratio is the most important factor in reducing costs. In the present study there was no increase in the daily food intake by pigs on either antibiotic, compared with their respective controls, thus the stimulation of growth is apparently entirely attributable to a better utilisation of the available food.

Fig 2.
GROWTH RATES
ANIMAL & VEGETABLE PROTEIN

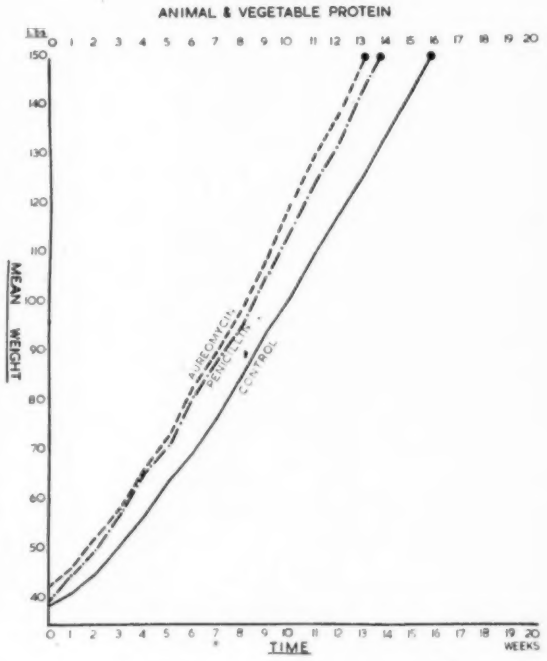


Fig. 3
COMPARISON OF GROWTH RATE IN PIGS ON SUPPLEMENTED AND UNSUPPLEMENTED DIET
(Expressed as percentage increase over control)

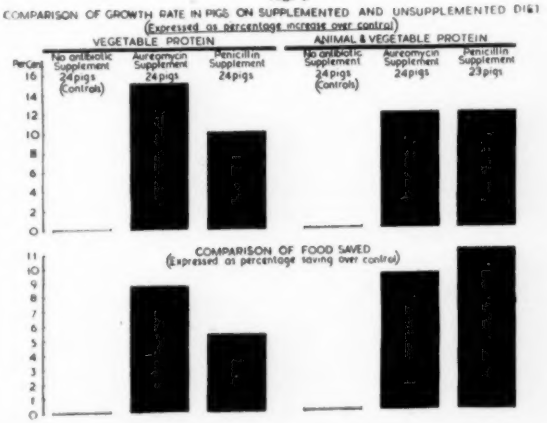

VEGETABLE PROTEIN
ANIMAL & VEGETABLE PROTEIN
No antibiotic Supplement 24 pigs (Controls)
Aureomycin Supplement 24 pigs
Penicillin Supplement 24 pigs
No antibiotic Supplement 24 pigs (Controls)
Aureomycin Supplement 24 pigs
Penicillin Supplement 23 pigs
COMPARISON OF FOOD SAVED
(Expressed as percentage saving over control)

TABLE III

COMPARISON OF GROWTH RATE AND FOOD CONVERSION OF TREATED AND CONTROL PIGS

Pen	Replicate	Antibiotic supplement	Growth rate (lb. per day)	Growth rate increase (expressed as per cent. of controls)	Mean time saved (days)	Conversion ratio (lb. of food per lb. live weight gain)	Food saved (expressed as per cent. of controls)
A§	1	None	1·04	—	—	3·87	—
	2		0·99			3·84	
	3		0·95			4·22	
			0·99			3·98	
B§	1	Aureomycin	1·23	15·2 (28·6)	31	3·45	8·79 (17·3)
	2		1·09			3·64	
	3	Hydrochloride	1·11			3·79	
			1·14			3·63	
C§	1	Procaine	1·18	10·1 (19·9)	20	3·57	5·28 (12·2)
	2		1·02			3·83	
	3	Penicillin	1·08			3·91	
			1·09			3·77	
D¶	1	None	1·15	—	—	3·62	—
	2		1·09			3·80	
	3		1·02			3·92	
			1·09			3·78	
E¶	1	Aureomycin	1·24	12·0 (13·5)	16	3·39	9·52 (11·1)
	2		1·21			3·40	
	3	Hydrochloride	1·20			3·48	
			1·22			3·42	
F¶	1	Procaine	1·25	12·0 (13·5)	16	3·18	11·12 (9·6)
	2		1·27			3·26	
	3	Penicillin	1·13			3·64	
			1·22			3·36	

Figures in brackets represent values when pigs are at 100 lb. live weight.
Ration : § Vegetable protein ; ¶ Animal protein.

TABLE IV

RESULTS OF CARCASE ASSESSMENT IN TREATED AND CONTROL PIGS

Pen	Replicate	Antibiotic supplement	Number of pigs examined	Ministry of Food educational grading Grade "A" carcases	1939 contract grading Grade "A" carcases	Total marks*	Mean mark per pig
A§	1	None	8	5	5	492	61·5
	2		8	7	6	437	54·6
	3		8	6	6	438	54·8
							57·0
B§	1	Aureomycin	8	7	5	500	62·5
	2		8	8	7	434	54·3
	3		8	7	7	485	60·6
							59·1
C§	1	Penicillin	8	7	7	505	63·1
	2		8	8	7	440	55·0
	3		8	8	6	436	54·5
							57·5
D¶	1	None	8	7	7	488	61·0
	2		7	6	6	436	62·2
	3		7	7	7	405	57·9
							60·4
E¶	1	Aureomycin	8	7	7	462	57·8
	2		8	8	8	492	61·5
	3		8	8	8	441	55·1
							58·1
F¶	1	Penicillin	8	6	6	502	62·8
	2		7	7	6	417	59·6
	3		7	3	3	404	57·7
							60·0

* Marks allocated as follows :—

	Per cent.		Per cent.		Per cent.
Length	10	Reduction of fat ...	5	Rind	5
Shoulder fat	15	Shape of gammon ...	5	Proportion of lean to fat	20
Thickness of streak ...	10	Quality of fat ...	15		
Proportion of cuts ...	10	Fineness of bone ...	5		

Basic ration : § Vegetable protein ; ¶ Animal protein.

TABLE V

COMPARISON OF PRODUCTION COSTS OF CONTROL PIGS AND THOSE RECEIVING ANTIBIOTIC SUPPLEMENT
(Excludes cost of Antibiotic)

Pen	Replicate	Supplement: Antibiotic	Supplement: Quantity (grammes per ton)	No. of pigs	Original value of pigs (estimated) £	Total food consumed Lb.	Total value of food (purchase price) £‖	Time on experimental ration, pig days	Estimated labour (at 4 min. per pig day) (hours)	Total labour cost £	Miscellaneous costs 5 per cent. gross output £*	Total costs £	Cost per pig £	Total proceeds £	Total profit £	Profit per pig £	Mean profit per pig £	Increase in profits on supplemented ration: Per pig £ s.	Increase in profits on supplemented ration: Per cent.	Profit as per cent. gross output
A§	1	None	—	8	44	5,098	74·6	1,267	84·47	10·6	6·3	135·5	16·9	162·1	26·6	3·33				
	2			8	44	5,452	79·8	1,426	95·07	11·9	7·1	142·8	17·9	172·3	29·5	3·69	3·4	—	—	22
	3			8	44	5,708	83·6	1,419	94·60	11·8	7·1	146·5	18·8	172·1	25·6	3·20				
B§	1	Aureomycin		8	44	4,580	67·1	1,084	72·27	9·0	5·4	125·5	15·7	167·0	41·5	5·19				
	2		28·8	8	44	5,024	73·6	1,258	83·87	10·5	6·3	134·4	16·8	174·0	39·6	4·95	4·8	1 8	41	31
	3	Hydrochloride		8	44	4,904	71·8	1,167	77·80	9·7	5·8	131·3	16·4	164·4	33·1	4·14				
C§	1	Procaine		8	44	4,585	67·1	1,086	72·40	9·1	5·4	125·6	15·7	164·7	39·1	4·89				
	2		15·4	8	44	5,236	76·7	1,342	89·47	11·2	6·7	138·6	17·3	169·1	30·5	3·81	4·4	1 9	29	28
	3	Penicillin		8	44	5,156	75·5	1,216	81·07	10·1	6·0	135·6	17·0	171·0	35·4	4·43				
D¶	1			8	44	4,839	73·2	1,165	77·67	9·7	6·4	133·3	16·7	170·8	37·5	4·69				
	2	None	—	8	44	5,123	77·5	1,238	82·53	10·3	6·8	138·6	17·3	162·7	24·1‡	3·01	3·8	—	—	25
	3			8	44	4,924	74·5	1,225	81·67	10·2	6·7	135·4	16·9	163·9	28·5‡	3·56				
E¶	1	Aureomycin		8	44	4,473	67·7	1,065	71·00	8·9	5·8	126·4	15·8	174·5	48·1	6·00				
	2		28·8	8	44	4,686	70·9	1,139	75·93	9·5	6·2	130·6	16·3	169·6	39·0	4·88	5·6	1 16	47	34
	3	Hydrochloride		8	44	4,548	68·8	1,090	72·67	9·1	6·0	127·9	16·0	174·8	46·9	5·86				
F¶	1	Procaine		8	44	4,313	65·3	1,084	72·27	9·0	5·9	124·2	15·5	166·8	42·6	5·33				
	2		15·4	7†	38·5	3,976	60·2	959	63·93	8·0	5·2	111·9	16·0	149·0	37·1	5·30	4·8	1 0	26	31
	3	Penicillin		8	44	4,347	65·8	1,057	70·47	8·8	5·8	124·4	15·6	154·7	30·3‡	3·79				

* " Gross output " is a measure of the increase in value of the pigs since the commencement of the experiment.
† One pig removed from experiment due to pneumonia.
‡ One pig slaughtered before reaching bacon weight due to pneumonia.
‖ Vegetable protein diet at £32·79 per ton. Mixed protein diet at £33·90 per ton.
Basic ration :—§ Vegetable protein ; ¶ Animal protein.

Under certain circumstances, not yet understood, we have observed a complete absence of response to either antibiotic under conditions similar to those which have previously favoured consistent growth stimulation. To understand such variations in response, and to appreciate any possible dangers, it is obviously necessary to study the mechanism by which growth rate may be increased. This mechanism is not yet understood although many hypotheses have been presented which may constitute a partial explanation[13 31 32 33]. It was at first suggested[34] that the bacterial flora of the digestive tract could be beneficially modified by reducing the number of organisms which compete with the host for nutrients or which produce toxins within the digestive tract[36]. Alternatively, an increase might occur in organisms beneficial to the host. Numerous workers[37 38 39 40 41 42 43] report different variations in the viable count of such organisms and growth stimulation still occurs when there is no detectable variation in intestinal flora[44]. Nevertheless, it has been shown that chicks hatched and reared in a bacteria-free environment will not benefit from an antibiotic supplement. The same workers have shown that chicks when housed in a much-used chick house may show marked response to a penicillin supplement, but no response when in a new building[45]. Similarly, pigs kept in conditions of strict cleanliness may show no response[20]. Upon such evidence is based a theory of a "latent infection" normally depressing the growth rate[46].

Antibiotics, especially aureomycin and terramycin, when administered as a feeding supplement may have a more obvious effect in reducing the incidence of certain disease conditions, which may account for the dramatic response which has been observed following the administration of an antibiotic supplement to "runt" pigs[10 47 48], and to scouring calves[10], and piglets[49 50]. The feeding of a penicillin supplement to poultry, especially turkeys[51], has been shown to reduce markedly the incidence of early non-specific mortality[52]. The concentration of antibiotics detectable in the digestive tract and tissues of animals on antibiotic supplements is important, and is at present being investigated at this research station.

There is some evidence that a very low concentration of certain antibiotics may act simply as a metabolite for the host animal[53], but considering all the available evidence it seems more probable that any improvement of metabolism results from the effect on the intestinal flora, a fact which might not readily be elucidated from a study of variations in bacterial viability.

From these remarks it can be seen that whereas the existence of the growth-promoting properties of antibiotics is beyond doubt, our understanding of the mode of action is yet far from complete.

Summary

A study has been made of the effect of supplementing the diet of pigs with antibiotics. The experiment was carried out on three replicate groups totalling 143 pigs of from 10 weeks old (about 40 lb. weight) which were reared until they reached bacon weight (about 210 lb.).

Under the conditions described :—

1. An increase in growth rate on a supplemented vegetable protein ration ranging from 10 to 15 per cent., and a reduction in food consumption ranging from 5 to 8 per cent. was obtained.

2. Growth rate on a supplemented animal protein ration was increased by an average of 12 per cent. and food consumption reduced by 9 to 11 per cent.

3. The increases in growth rate and reductions in conversion ratio were statistically significant, but differences between penicillin and aureomycin were not significant with the number of animals involved.

4. No significant variation in carcase quality was observed following the feeding of either antibiotic.

5. Production costs were compared and an increase in profit of £1 to £1 16s. (26 to 47 per cent.) per pig was recorded on supplemented diets excluding the cost of the antibiotic supplement.

6. The occasional lack of response to antibiotics under certain conditions is confirmed and the importance of a better understanding of the mode of action is emphasised.

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Discussion

Dr. W. M. Mackay (London): He wished to congratulate Dr. Gordon on his very interesting paper and to make some very brief remarks on the work the organisation with which he was associated had carried out within the previous two years. By and large, experiments had been carried out on between 30 and 40 farms in the country. Just as there was a variety of experimental conditions, so was there a variety of results, and not in every case was there the consistent result which Dr. Gordon had had. Again taking things by and large, if the conditions were good—the housing and management and diet—and if the animals were healthy, little was obtained in the way of response to antibiotics. If, on the other hand, housing and management was bad, there was a response, either slight or significant. If there were bad conditions as regards housing and disease, sometimes quite spectacular results followed from feeding antibiotics.

It was necessary to judge how the antibiotics might be used. One farmer would use food with antibiotics in it, and another might not. In the variety of tests carried out, antibiotics were given to pigs as soon as they were able to eat until the age of eight weeks and then stopped; up to 100 lb. and then stopped; until the age of eight weeks, then stopped, and then started again up to 100 lb. In addition, non-supplemented food had been given at a variety of times. There was sufficient evidence to show that in order to get the best results from the antibiotic it had to be given as early as possible in the young pig's life—as soon as it would start to eat. After that the effect seemed to wear off considerably. Provided the antibiotic was included at the time the pig started to creep feed the same results were obtained. If one gave it at weaning the result was less, and if started at 100 lb. there was practically no result at all. A dosage rather smaller than that of Dr. Gordon's was given—5 grammes of penicillin per ton, and 18 grammes of aureomycin per ton. If the cost of the antibiotic and the cost of the mixing were deducted, it brought down the additional profit quite considerably—about £1 per pig.

If an antibiotic was used, apparently a post-weaning check was avoided. The following was a table of results.

At the age of eight weeks, the controls, without antibiotics, weighed 35 lb.; those with antibiotics up to eight weeks only weighed 35 lb. also; those with antibiotics up to 100 lb. weighed 33 lb. At 10 weeks the controls weighed 36 lb., those with antibiotics up to eight weeks only weighed 45 lb., those with antibiotics up to 100 lb. weighed 43 lb. At 12 weeks the controls weighed 46 lb.; those with antibiotics to eight weeks weighed 53 lb.; those with antibiotics up to 100 lb. weighed 54 lb. The controls had gained 11 lb.; those with antibiotics to eight weeks only 18lb.; and those with antibiotics to 100 lb., 21 lb.

The important question of grading had been examined because there was no use at all in going to the added expense of putting antibiotics into the food if they were merely going to represent an increase in back fat, which was going to mean a down grading of the pigs once they were slaughtered.

There was the question of whether antibiotics found their way from the gut into the tissue and whether they would cause a stoppage of the bacterial activity and stop a breakdown of nitrates to nitrites of the saltpetre. No evidence in the tissue was found at all and no alteration in the cure. With the tremendous amount of publicity and propaganda that orginated largely in America, a great deal was expected from the antibiotics and it was thought that there would be a tremendous demand for them in this country. The demand had been considerably less than they expected.

Dr. Gordon: He thought he had been guarded in saying that " with the particular ration used and with the particular antibiotics that were added " there had been a significant result in these experiments. There had been, however, a few experiments on different diets in which there was not a very marked response for reasons not yet clear. One could say, however, that it was usual to get a response. As to the fact that the best response appeared to occur in young, rapidly growing animals, that was exactly what was said in the paper. The point was common ground.

Dr. Mackay: That was not quite so. Dr. Gordon's chart advocated the use of antibiotics at weaning. It was better to start before that time.

Dr. Gordon: The statement that response was greatest in the young, rapidly growing animal was one with which he was in full agreement. A better result might be obtained if a start was made during the creep feed period of the young pig. That was found to be true in the case of foals. It was possible to increase the growth rate in foals by placing the antibiotic at the back of the tongue of the foal during suckling. There were some adequately controlled experiments to show that an increase in the growth rate of 12 per cent. in the sucking foal could be expected.

He had not dealt with sufficient numbers to know if the addition of the antibiotic would help to reduce some of the " childhood " complaints of the young animal.

Figures had been obtained for the rearing of calves fed on milk only and fed to their maximum desire. It was interesting to know that a calf would, if allowed, drink up to 5 gallons of milk a day. That was quite uneconomical, but it produced calves of great quality the like of which he had never seen before!

About 120 calves were used in the calf experiment. There were two different diets. One was wholly milk and the other was the type of diet the economically minded farmer would want to feed—dried milk concentrates and hay. With the addition of penicillin to those two diets there was very little difference between the treated and control groups. In the case of the first group there was a 1 per cent. increase in the growth rate—not of very much significance—and in the case of the animals fed on concentrates and hay the increase was approximately 3 per cent. It might be that aureomycin would give a better result in calves. Most of the literature dealt with that and very little dealt with the addition of penicillin to the diet of calves.

With regard to profit—Mr. Mackay seemed to suggest that the profit that was indicated should be reduced by £1 per head. There might be others present who knew better what the cost of the antibiotics would be when they were being issued on a commercial basis, but it was not likely that the cost would be £1 per pig. According to the best information Dr. Gordon had at the time—which, if incorrect, would no doubt be corrected by someone who knew more about the subject—the cost would be roughly 3s. to 5s. a pig for aureomycin, and about 4s. to 5s. for penicillin. That still made the use of antibiotics worth while for the farmer. Pigs were kept at Compton and on the result of the experiments so far undertaken he had concluded that it would be sound policy to use a diet supplemented with antibiotic.

Dr. Mackay: In case the impression had been given that he was not in favour of antibiotics, he wanted to repeat that, with bad conditions and disease, one could sometimes get spectacular results from antibiotics. As perhaps most of the pig farmers in the country had such conditions, that point should be made clear. In trying to put over a lot of facts in a short space of time the wrong impression might have been created. Also, he had intended to say £1 per ton of food, not £1 sterling per pig.

A Member: Would Mr. Taylor say something about what he

was doing and endeavour to explain something about the mechanism of reaction and tissue storage? The paper said that vitamin B_{12} was added to all rations containing antibiotics at the rate of 15 mg. per ton. Was this done irrespective of vitamin B_{12} already contained therein? Did the results obtained justify the reduction or omission of animal protein in pig rations? In the work that had just been discussed aureomycin was added to the extent of almost 30 grammes per ton, and about half that quantity in the case of penicillin. The Order which allowed compounders to include antibiotics only required 4 grammes in the rearing and fattening meals for pigs. Could this anomaly be explained? Could one expect to obtain any advantage with that low level?

Mr. J. H. Taylor (Compton): With regard to lack of response to antibiotics, insufficient work had been done in this country so far to compute the percentage of animals in which there was no response. In America, however, this type of work had been done for some years and an extensive survey of the effects of feeding a number of antibiotics to the pig had been made by Braude, Wallace & Cuhna. Their survey covered 227 experiments and it was reported that in 9 per cent. of these there was no stimulation of the growth rate and in 22·5 per cent. of cases there was no saving in food conversion. The experiments covered a fairly wide range of systems of management and of feeding.

At Compton, pigs had been fed on rations with up to 130 grammes of penicillin per ton. Pigs were slaughtered very soon after feeding, when it was known there was penicillin present in the blood and tissues, and sent to the local bacon factory. The curers had examined them and could find no difference between the treated and the control pigs.

The level of antibiotics in the tissues of animals receiving an antibiotic supplement was a subject which had been investigated in the previous year, having examined various levels in the digestive tract, the blood stream, and the tissues of animals fed with penicillin, and aureomycin, separately, on doses of from half a gramme to 130 grammes per ton. Investigations had dealt with the rat, the pig, the calf and the young foal. To try to summarise the results was a little difficult. There was a variation with the different antibiotics. In the case of penicillin, one could expect to detect a low concentration in the stomach and small intestine, but not in the large intestine or caecum, with a dose of up to 130 grammes per ton. That was interesting in regard to the changes of bacterial flora in the tract.

In the case of aureomycin, one could detect considerable quantities throughout the digestive tract and in the faeces. In the case of blood levels, the results were lower, but levels of aureomycin and penicillin could be detected in the blood after feeding an antibiotic, within a short period of perhaps one to two hours. The levels of aureomycin were generally higher than those of penicillin, but penicillin had been detected in the blood of pigs which had been fed a ration containing 15 grammes per ton. That was a low concentration, but the methods of assay depended upon the inhibition of bacteria. There were concentrations of penicillin or aureomycin in the blood of these pigs which would inhibit the growth of certain bacteria.

With regard to vitamin B_{12}, aureomycin hydrochloride had been fed, as stated in the paper, as Aurofac. Vitamin B_{12} also had been fed in the ration with penicillin.

As to whether animal protein could be dispensed with, the answer, generally speaking, was no. The action of an antibiotic was essentially to increase an animal's efficiency in utilising food, and, therefore, if a good ration was fed there would be a larger increase in growth rate. That had been shown by some American workers in relation to the oral administration of glucose to two groups of pigs. One received aureomycin hydrochloride and the other did not. In the first case, there was subsequently shown to be a higher blood glucose level than in the control animals. This suggested a better utilisation of the food rather than a substitution of certain factors in the ration. As to the recommendations of the compounders, that was rather outside the scope of the paper because very little work had been done at Compton to compute the optimum level of antibiotics. At the moment, only the concentrations which had been fed in the present experiments were being reported. He would not like to forecast the result with a different ration and with a different quantity of antibiotic. Certainly in the chick a response has been reported with as little as 1·25 grammes procaine penicillin per ton.

Stability of antibiotics in foods was a complex question on which much had been done in the last two years. There were three or four variables in this question. First of all there was the antibiotic and the type of food with which it was mixed. There was also the factor of the condition under which it was stored and whether the food was compounded or pelleted. It had been found that aureomycin tended to be more stable in feeding-stuffs than penicillin. Aureomycin and penicillin were the only two antibiotics which had been dealt with in this connection.

The type of food was a question that had not been investigated fully but it was known that there were certain factors in feeding-stuffs which would tend to inactivate an antibiotic. Premixing with a mineral supplement would tend rapidly to inactivate normal penicillin. Work had been done to produce a type of penicillin which was not affected, but the normal penicillin was rapidly inactivated.

Other things, such as oat offals, tended to inactivate penicillin. The processing of foods had a deleterious effect on penicillin and aureomycin and it had been estimated that 15 per cent. of the potency of aureomycin and up to about 40 per cent. of the potency of penicillin might be lost. It was difficult to say what length of time any food could be stored without loss of antibiotic activity. At Compton, under the conditions of storage of the ration to which reference had been made, there had been no significant loss of activity over a period of 12 months. That was not a normal finding and there was often a loss of up to perhaps 20 per cent. after approximately two months in the case of penicillin, and something a little less in the case of aureomycin. The samples examined had been stored in sacks in the granary at Compton under cool, dry conditions.

The Chairman: The subject they were dealing with could go on for a long time, but it was now necessary to close the meeting. The speakers they had listened to that morning had been working in highly specialised fields and had given the meeting an insight into their work. Members were grateful to all those who had spoken for giving their time and experience, and would no doubt wish to accord them a very hearty vote of thanks. (Applause.)

CLINICAL COMMUNICATION

CANINE FILARIASIS IN IRAQ

FRANK H. MANLEY*
AND
ABDUL SATTAR BARAZANJI
Veterinary Laboratory, Baghdad, Iraq

In various parts of the world considerable interest is being shown in canine filariasis and a number of articles on the subject have appeared recently in veterinary literature. This note on incidence and treatment may, therefore, be of some value. Only a few of the more recent references are mentioned here. Drudge (1952) made a study of the treatment of canine filariasis with arsenamide, given intravenously and orally. He concluded that the oral route was not satisfactory since there was failure to produce a lethal effect against the adult filaria. He considered that degradation and inactivation of the arsenamide occurred before, during and after enteric absorption. McGaughey (1952) found the incidence in Ceylon to be about 33 per cent. He describes the effect of treatment of nine dogs with diethyl-carbamazine. Clinical improvement and reduction of numbers of microfilaria were slow, compared to results recorded in treatment of *D. immitis* infections in U.S.A. and Africa. He suggests prophylactic treatment with caracide in districts where infection is common. Vaughan (1952) recently reported four cases in which eczema was the predominant clinical sign. These cases were seen in St. Kitts, British West Indies. Dhayagude (1952) reported that about 5 per cent. of street dogs in Bombay were infected, as indicated by examination of the peripheral blood, although apparently not suffering any inconvenience from the infection. It is evident that canine filariasis has a wide distribution and microfilaria frequently occur in the peripheral blood without causing obvious symptoms. Varying degrees of success in treatment have been recorded with a considerable number of dogs. Piercy (1951) reported a cure in Kenya by the use of stibophen. As this latter drug is readily available here it was used in our treatment experiment.

* Professor F H. Manley, FAO Bacteriologist, on leave from School of Veterinary Medicine, Auburn, Alabama.

Incidence

The dogs we examined, apart from the hounds of the Baghdad Hunt, were those brought to the neighbouring veterinary hospital for various reasons. Invariably a clinical diagnosis of filariasis had not been made. For the determination of microfilaria in the peripheral blood we relied simply on the microscopical examination of a fresh drop of blood, most of the examinations being made between 9 and 11 a.m.

Results		Examined	Positive
March	...	11	1
April ...	...	24	8
May ...	...	34	15
June ...	...	19	5
July ...	...	17	3
August	...	2	0
		107	32

Treatment with Stibophen

The stibophen used was Wellcome brand of 5·3 per cent. aqueous isotonic solution of sodium antimony biscatechol-3 : 5-disulphonate, for intramuscular, or rarely, intravenous injection. It contains 8·5 mg. of trivalent antimony per c.c.

Six hounds from the Royal Hunting Club, Baghdad, which were in an extremely debilitated condition, were seen at the veterinary hospital. There was a history of previous distemper. All were positive for filariasis on examination of the peripheral blood. Hound number one received a total of 30 c.c. stibophen, intramuscularly, over a period of 10 days. It died on the 10th day. After a total of 13 c.c. had been given the blood was negative for filaria. *Post-mortem* examination revealed pericarditis, hepatitis and chronic pneumonia lesions. Hound number two died after a total of 9 c.c. stibophen had been given over a period of three days. *Post-mortem* examination revealed enteritis, nephritis and hepatitis. Hound number three received 6 c.c. stibophen daily for seven days. The animal died on the eighth day. The carcase was emaciated and on *post-mortem* examination there were signs of chronic enteritis. Hound number four received 6 c.c. stibophen daily for five days. The blood was negative on the third day. The animal died on the sixth day. *Post-mortem* degenerations were advanced but marked changes in the liver could be noticed. No adult worms could be found in the heart in any of the above four cases. Hound number five received 48 c.c. of stibophen over a period of 13 days. The blood was negative from the fifth day after 18 c.c. of the drug had been given, and remained negative for 18 days after treatment ceased. Hound number six received 48 c.c. stibophen over a period of 13 days. Blood was negative on the 10th day when a total of 36 c.c. had been given. The blood remained negative for 18 days, after treatment ceased.

Five apparently healthy hounds were submitted for treatment and three others held as controls. All were showing filaria in the peripheral blood. All the treated animals received 6 c.c. stibophen, daily, for eight days. One became negative after receiving 24 c.c., three after receiving 36 c.c. and one after receiving 48 c.c. The controls remained positive throughout. Two of the treated dogs showed some slight indisposition after the final inoculation, but recovered quickly. Two showed considerable thickening of the mucous membrane of the nostrils and the skin of the nose.

Treatment of these five dogs commenced on May 18th. Following the completion of treatment, the blood was examined on June 2nd and 12th, July 5th and August 19th, with negative results. The three controls remained positive to July 7th when they were included in the following experiment.

Four positive fox hounds received 6 c.c. stibophen intramuscularly for eight consecutive days. Two became negative after the sixth injection and one after the eighth injection. One hound died after the fifth injection. It had shown no toxic symptoms during the treatment. Prior to treatment it was considered to be below normal. Immediately prior to death there was epistaxis. The *post-mortem* examination was not conclusive. There were no adult worms in the heart. Treatment of these hounds commenced on July 7th and ceased on July 15th. Subsequent blood examinations were made on July 19th and August 19th. On the latter date one of the hounds was positive, very few microfilaria being detected. It received another dose of stibophen and when examined on July 25th the blood was negative.

Conclusions

The incidence of canine filariasis in Baghdad in the summer months, as indicated by the presence of microfilaria in the peripheral blood, is in the region of 30 per cent.

Eight intravenous injections, each of 6 c.c. of stibophen, will usually clear the peripheral blood of microfilaria. Further experimentation with this drug appears to be justified.

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ABSTRACTS

Aetiology, Prophylaxis and Treatment of Bovine Mastitis*

In this paper an account is given of work undertaken by the personnel of the Program for Research and Control of Mastitis in the State of New York. On the question of aetiology, the research was concentrated on finding the weakest link in the chain of infection from one animal to another. *Str. agalactiae* was the organism chosen for these studies. Experiments carried out in the undamaged teat showed that milk itself had little or no bacteriostatic action, and at best could only prolong the period of slow growth of the infecting organism for a few hours. Again it was shown that the undamaged teat canal offered no barrier to infection by small numbers of organisms, but if the canal was irritated by rubbing with cotton wool, it provided quite an effective resistance to infection. No confirmation was found for the theory that herds cleared of *Str. agalactiae* and haemolytic staphylococci are thereby rendered more subject to coliform mastitis.

The milking machine is a factor of increasing importance in the aetiology of mastitis. At some time or other most machines become faulty in action, partly due to wear, and partly to

* **Etiology, Prophylaxis and Treatment of Bovine Mastitis** (Trans. title.) Fincher, M. G. (1953). Int. Vet. Con., Stockholm. 1.

ignorance on the part of those who use them. The main fault lies in variation in the vacuum pressure, and it is suggested that veterinarians interested in the problem of mastitis should carry pressure gauges as part of their normal equipment to check the vacuum at various points in the milking machinery. Too great a vacuum causes eversion and oedema of the teat end, and may draw part of the udder into the sleeve. A weak vacuum, by prolonging the milking time and insufficiently emptying the udder, likewise predisposes to mastitis. Another result of too high a vacuum is the milk lock, in which some of the milk, instead of flowing to the milk pail, reverses direction, so that the teats are kept constantly moist and the udder is incompletely milked. The solution to this problem is to let in some air at the base of the pulsators but this in its turn may cause excessive humidity (through vaporisation of milk) and in itself pave the way to infection. Each machine should have two sets of rubber sleeves so that the set not in use may be degreased and rid of deposits of calcium. Each set should be sterilised and rested for 8 to 10 days to prolong the life of the rubber. An important point in the use of the milking machine is the actual milking time. It must be remembered that milking time decreases as lactation advances and also that individual cows vary in the time required for milking. Nor must it be forgotten that the veterinarian himself may set up infection by careless sterilising technique, or by the use of new untried therapeutic agents which may cause irritation of the udder. Feeding seems to have little or no effect on the incidence of mastitis.

Prophylaxis in mastitis consists of attention to cleanliness in the surroundings in both byre and pasture, and avoidance of the faults mentioned above as predisposing causes. It is wise to separate the heifers and healthy cattle from the older infected cattle.

Treatment involves exact diagnosis and specific treatment by veterinary surgeons. Generally, it is by penicillin, or penicillin and streptomycin injections, and other antibiotics are used as required. Streptomycin has been found useful in acute coliform mastitis. In badly affected herds where no bacteriological examination is possible it may be helpful to inject each quarter of every udder just before the dry period and again while the animal is dry. A third or even fourth injection may be necessary in the worst cases.

I. W. J.

* * * * *

Studies on Ketosis of Ruminants*

Depriving dairy cows of food for periods of five days at the height of lactation caused a marked decrease in their milk yield. The cows did not lose their appetite and ate readily when food was again given to them; even so, they were slow to regain their milk yield. A progressive ketonaemia developed during starvation and β-hydroxybutyrate and acetone accounted for most of the total ketone bodies. Iso-propanol appeared in the blood in small quantities and in greater concentrations in the rumen liquor. Acetone, aceto-acetate and β-hydroxybutyrate also appeared in the rumen liquor and the suggestion is made that acetone was the precursor of iso-propanol and that conversion of acetone to iso-propanol occurs in the rumen as a result of bacterial activity.

The changes formed in the blood of non-lactating cows were less pronounced. Complete starvation during late pregnancy, however, caused changes that were similar in magnitude to those found during lactation.

Two possible explanations are offered: the first is that high producing cows are unable to produce sufficient carbohydrate from tissue proteins and fat to prevent ketosis or, alternatively, that compensatory changes are less effective in ruminants; the second is that body reserves are so low during late pregnancy and lactation that complete compensation on fasting is impossible.

A. T. P.

* **Studies on Ketosis of Ruminants.** Robertson, A., & Thin, C. (1953). Int. Vet. Congr., Stockholm. **1.** 531-535.

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Dihydrostreptomycin Dose-Serum Level Relationships in Cattle*

The author undertook this study to help in arriving at effective and economical dosage schedules. Dihydrostreptomycin, the hydrogenated derivative of streptomycin, closely resembles the parent compound both as to antibacterial spectrum and pharmacological properties. A crystalline form and an aqueous solution were used and a few trials given to a pectin-procaine solution. The doses used were 5 and 7·5 mg. per lb. bodyweight administered intramuscularly. Full details are given of the experiments carried out, complete with methods used and tables of results.

The author discusses the limitations and possibilities of using such data as he presents and tentatively suggests that this drug be administered to cattle intramuscularly at a rate of 5 mg. per lb. b.w. every 8 to 12 hours wherever possible.

J. C. V. H.

* **Dihydrostreptomycin Dose-Serum Level Relationships in Cattle.** Hammond, P. B. (1953). *J. Amer. vet. med. Ass.* **122.** 203-206.

* * * * *

Post-partum Acetonaemia Therapy*

Various remedies for post-partum acetonaemia have been studied. Choline chloride injected in 5 to 10 g. doses cured some cases. Pot. chlorate in 50 to 70 g. doses by mouth cured 50 per cent. of cases; blood acetone fell from 19·1 to 9·5 mg. per cent. Pot. chloride by mouth in 40 g. doses cured one case out of nine. Sod. chlorate in 60 to 80 g. doses reduced blood acetone from 22·7 to 7·3 mg. per cent.; toxic signs were not observed. Exercise and ACTH therapy were also tried. The author prefers exercise rather than the expensive hormone and 25 to 35 grammes of chlorate by mouth and daily exercise are recommended for solitary cases of acetonaemia.

F. A.

* **Investigations Into the Results of Some Therapies against Acetonaemia Post-partum.** Talsma, D. (1953). Proc. Int. Vet. Congr., Stockholm. **1.** 536.

WILLIAM McILRATH FELLOWSHIP FOR RESEARCH AND TEACHING IN ANIMAL HUSBANDRY

In its issue of October 31st, *Nature* records that the Australian Commonwealth Scientific and Industrial Research Organisation has decided to apply a gift of £A.50,000 from Mr. William McIlrath, owner of the Windsor Hereford Cattle Stud, Delungra, N.S.W., to found the William McIlrath Fellowship for scientific research and teaching in the broad field of animal husbandry. "The first to be appointed to this Fellowship is Dr. M. C. Franklin, principal research officer at the Organisation's McMaster Animal Health Laboratory, Sydney, who has been engaged on research on animal husbandry for many years, and whose work on animal nutrition is well known. Dr. Franklin will be concerned mainly with work on beef cattle dietetics and his research will be undertaken in collaboration with the Faculty of Veterinary Science of the University of Sydney and with the Division of Animal Health and Production of the Commonwealth Scientific and Industrial Research Organisation. His work will add to the Organisation's increasing programme of research on problems affecting the Australian cattle industry while at the same time strengthening university teaching and research. It is clear that there is a great potential for increased production in Australia through the application of scientific knowledge in feeding, breeding methods and other problems of animal husbandry."

REVIEW

[The Sulphonamides and Antibiotics in Man and Animals. (Second Edition: J. Stewart Lawrence and John Francis). Pp. 482. London: H. K. Lewis & Co. Ltd. Price 42s.]

It is seven years since the first edition of this book was published; at that time there was a large body of knowledge of the sulphonamide drugs, but the information on penicillin was fragmentary and the more recent antibiotics were unknown. This second edition has been thoroughly revised and expanded; apart from full information on the sulphonamides it now includes the sulphones, the thiosemicarbozones, para-amino-salicylic acid and iso-nicotinyl hydrazide.

The chapters on the antibiotics deal with penicillin, streptomycin, neomycin, aureomycin, chloromycetin and terramycin. There are useful general discussions on the mode of action of these agents, the problem of drug resistance and their pharmacological properties. Each agent is also considered separately and its possible uses critically assessed. The junior author has contributed two excellent chapters on the place of these products in veterinary medicine, as well as the chapter on the sulphones and thiosemicarbozones.

As the authors state in their introduction, the emphasis is chiefly on the clinical aspect and the practical use of the antibacterial agents in controlling bacterial infections. This fully documented text-book should be readily available to all who wish to use intelligently the extensive range of modern antibacterial agents, whether it be in human or veterinary medicine.

VICTORIA VETERINARY BENEVOLENT FUND

MEETING OF COUNCIL

A meeting of the Council of the Victoria Veterinary Benevolent Fund was held at No. 10, Red Lion Square, London, W.C.1, on Wednesday, September 30th, 1953, when the following members were present: Professor J. B. Buxton (President) in the chair, Mr. H. W. Dawes, Mrs. Daisy I. Glover (President, Ladies' Guild), Professors J. McCunn, P. E. Mullaney and Mr. Arnold Spicer. Mr. C. W. Francis, Secretary, was in attendance.

Congratulations to Member of Council.—Before commencing the business on the agenda the President extended the Council's heartiest congratulations to Mrs. D. I. Glover on her election to the presidential chair of the Ladies' Guild for the ensuing year.

Minutes.—The minutes of the previous meeting, held on June 30th, 1953, having been published, were taken as read and signed as correct.

Death of Mr. John Holroyd.—The Secretary reported with deep regret the death of Mr. John Holroyd, F.R.C.V.S., D.V.S.M., member of Council since 1940, which took place on July 20th, 1953.

The PRESIDENT, after referring to the immense interest which Mr. Holroyd had at all times displayed in the work of the two Benevolent Funds of the profession and observing that his absence would be greatly missed by us all, moved from the chair:—

"That the sincere condolences of the Council be conveyed to Mrs. John Holroyd and family in the great bereavement which they have sustained."

The motion was carried in silence, all the members standing.

Apologies for Absence.—Apologies for absence were received from Professor R. E. Glover, Mr. L. E. Hughes, Captain W. R. McKinna, Mr. G. P. Male, Dr. R. F. Montgomerie, Captain Wm. Watt, Professor W. L. Weipers, Captain A. Whicher and Professor G. H. Wooldridge.

Correspondence.—(*a*) Captain A. Whicher.—The Secretary reported that on the instructions received at the last meeting he had written to this member asking him to reconsider his decision and that Captain Whicher had agreed, in view of the wishes of Council, to withdraw his resignation as a member of Council. This intimation was greeted with applause.

(*b*) Ladies' Guild.—A letter from Mrs. D. I. Glover, Hon. Treasurer, enclosing cheques for £500 and £300 for the Christmas Fund Account and the Current Relief Account respectively, was read.

The PRESIDENT expressed from the chair the Council's pleasure and delight at the wonderful support the Fund is continually receiving from the Ladies' Guild and it was unanimously agreed that the Secretary be instructed to convey the Council's grateful thanks to the Guild members for these handsome contributions which will be disposed of in accordance with their expressed wishes.

Treasurer's Report.—The Treasurer, Mr. H. W. Dawes, reported that he had arranged for the investment of the balance standing to the credit of the Donations Account, amounting to £300, in the purchase of £348 9s. 3d. 3½ per cent. Conversion Stock 1944/64.

The action of the Treasurer was approved.

ACCOUNTANT'S REPORT

The Secretary read the following report, which was approved, a vote of thanks being accorded to the respective donors:—

Since the previous meeting the following special subscription, legacy and donations have been received:—

Subscription

	£	s.	d.
V.V.B.F. Ladies' Guild (for current relief) ...	300	0	0
Legacy			
From the estate of the late Mr. J. C. James, M.R.C.V.S.	68	8	6
Donations: Collecting Boxes			
East Midland Division 1 10 0			
Scottish Branch, B.V.A. 2 15 9	4	5	9
Further share of profits of B.V.A. Accident and Insurance Scheme	22	7	1
E. P. Barrett (Elstead Conservative Association Show)	1	1	0
Association of Veterinary Teachers and Research Workers	10	0	0
C. Formston (Royal Veterinary College, Streatley, Golf Tournament)	2	10	0
J. R. Hudson	5	5	0
Lincolnshire & District Division	5	0	0
J. Livingstone (Life Membership)	10	10	0
John Macdonald (Uganda)	5	0	0
North of Scotland Division	10	0	0
P. A. Rogan	3	16	0
R.S.P.C.A., Southampton Branch	12	10	0
E. G. Sutton & E. R. Cook (British Timken Show)	1	1	0
A. Whicher (presented to Mr. Whicher in appreciation of his services to the Bexhill Horse Show)	20	0	0

R. A. Willett and Miss J. Chaplin (Windsor Championship Show) 5 5 0

£486 19 4

One new covenant for the payment of an annual subscription of £2 2s. has been received.

The sum of £54 10s. 7d. has been recovered from the Inland Revenue by the Secretary in respect of income tax on existing covenants.

Life Member.—It was resolved: "That Mr. John Livingstone, M.R.C.V.S., D.V.S.M., be elected a Life Member of the Fund."

CASES

No. 161. Widow; one daughter. The Secretary reported that the daughter had advised him that her mother died on September 16th, 1953, at the age of 72.

She had been a recipient of the Fund since 1932.

No. 275. Widow; aged 48; two sons, aged 19 and 17; eldest on National Service and the other son taking up farming. After reviewing the case in the light of recent information it was resolved "That the grant be continued for a further 12 months when it again be reviewed."

No. 286. M.R.C.V.S.; aged 73; married. Receiving help from the National Assistance Board and a small grant from the Fund. The Executive Committee reported that this member had sought urgent help from the Fund to pay off debts which had accrued amounting to £24 15s. 9d. The Committee decided in view of the nature of the debts to undertake payment and the Council confirmed the action of the Executive Committee.

No. 287. M.R.C.V.S.; aged 37; married; one child. Fractured leg: still unable to return to practice as he has to make daily visits to hospital.

It was agreed that the continuance of the grant of £1 per week be left in the hands of the Executive Committee.

Date of Next Meeting.—It was decided that this be left in the hands of the Executive Officers to arrange during January or February, 1954.

Vote of Thanks.—The meeting concluded with a hearty vote of thanks to the President for his conduct in the chair, proposed by Mr. Arnold Spicer and seconded by Mrs. D. I. Glover.

NEW MYXOMATOSIS VIRUS IN AUSTRALIA

The Canberra correspondent of *The Times*, in a message dated November 11th, records that, discussing the progress of the myxomatosis virus in the destruction of rabbits, Mr. Casey, Minister for External Affairs, said in the House of Representatives that scientists of the Commonwealth scientific industrial research organisation were developing a new virus, which was a mutant of myxomatosis, to destroy rabbits. During the past 12 months it had become apparent that rabbits were acquiring immunity from myxomatosis, but they would not have immunity from the new virus.

Since myxomatosis had been introduced there had been a progressive improvement in the area covered by the virus and in the percentage of rabbits killed. In the eastern states during the past year something like an 80 per cent. kill had been obtained and the value of primary production had been increased by £A.50,000,000.

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WEEKLY WISDOM

This twentieth-century iron curtain that has now descended, in the West as well as in Russia, upon scientific research is a deadly blow to experimental science, for the lifeblood of science since the close of the seventeenth century has been its freedom to exchange information and to publish it. Is technology going now to suffer the eclipse that overtook theology 300 years ago?—Professor A. J Toynbee (Seventh Gifford Lecture, New College, Edinburgh).

IN PARLIAMENT

Lord Carrington's Statement on Myxomatosis

In the course of the debate on farming policy, which took place in the House of Lords on Thursday of last week, Lord Rennell said that rabbits caused a loss of about £4,500,000 a year to wheat crops. It was a fantastic figure. When myxomatosis, which had been used to exterminate rabbits in Australia with success, broke out in Kent the immediate action of the Ministry of Agriculture was to net the farm and seek to exterminate the rabbits. Why were the Ministry at pains to make British farms safe for rabbits? It was a Gilbertian position. The rabbits were a pest, yet the Ministry of Agriculture were exterminating the exterminator. If the rabbit was to be protected from myxomatosis, why not the rat? If it was not humane to kill a rabbit with the disease, was it not inhumane to kill a rat with phosphorus? The disease was specific to rabbits and not harmful to other animals.

After further debate (on general farming topics), Lord Carrington, who is also Chairman of the Committee set up by the Minister of Agriculture and the Secretary of State for Scotland to advise on the effects of myxomatosis, said that Lord Rennell's arguments about the disease had been over-simplified. He had said that it killed rabbits, rabbits were a pest, therefore it was a good thing. But there were other considerations. It was by no means certain that it would be an unmixed blessing. To mention only one consideration, it caused acute suffering to the rabbits and the humanitarian aspect could not be disregarded. Although the disease appeared only to affect rabbits, and to some extent hares, it was a virus disease and it would be unwise to allow it to become established in this country before we knew much more about it. The results of the disease in Australia and France had been spectacular but the final results could not yet be assessed. It was reported that rabbits were beginning to appear in Australia which were immune to the disease and it could be imagined that when rabbits had been drastically reduced there would be plenty of food for the immune rabbits to multiply quickly. The result might be that Australia would have the rabbits still, and the disease as well.

The Minister of Agriculture had decided that the problem should be systematically investigated before he committed himself to a line of action which might have far-reaching consequences. He had appointed the Committee to consider the matter and had given instructions that efforts should be made to try to contain the present outbreaks as far as possible to leave the field clear for the Committee to consider the matter objectively. It might be that the Committee would advise him that the disease should be allowed to spread. It was better that such a decision should be deliberately taken rather than have it forced on the Minister by leaving the present outbreaks unchecked. Meanwhile the Committee had endorsed the Minister's action and it would be helpful if all farmers would intensify their efforts to destroy all rabbits on their land. Myxomatosis, even if it spread, would be no justification for relaxing the efforts to destroy rabbits by every means. The Committee would present a report before the spring.

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PROTECTION OF WILD BIRDS

The House of Lords has given a Second Reading to Lord Templewood's Protection of Birds Bill, which proposes the extension of powers to safeguard many wild birds, their nests, and eggs.

Among the provisions in its 15 clauses are prohibitions, except under specified circumstances, of the use for killing or taking any wild bird of any baited board or bird lime, any tethered live bird as a decoy, or any form of artificial light. The use of a mechanically propelled vehicle, boat, or aircraft "in immediate pursuit of a wild bird for the purpose of driving, killing, or taking that bird" will be an offence.

A further ground for proceedings will be unauthorised possession of any egg, including a blown egg, of a wild bird that has nested in the British Isles in a wild state. Persons who keep or confine a bird in a cage not large enough to allow it to stretch its wings freely may also be liable to a penalty.

The Bill specifies a special penalty for certain infringements of a fine not exceeding £25 or imprisonment for not exceeding a month for a first offence and not exceeding three months for a

second or subsequent offence, or both a fine and imprisonment. The liability in any other case will be to a fine not exceeding £5.

Clauses of the Bill deal with the protection of wild birds, their nests and eggs; prohibition of certain methods of killing or taking wild birds; restrictions on sales of live and dead wild birds and their eggs; restrictions on the importation of certain wild birds and eggs; and protection of captive birds.

Clause 2 deals with sanctuaries. Lord Templewood said he had found that the National Parks Act already provided everything that was needed, as well as compensation, where necessary. He suggested that, in committee, clause 2 should be deleted.

In the schedules is a list of 44 birds which, it is proposed, shall be protected at all times. It includes all species of eagles, the hoopoe, avocet, golden oriole, osprey, and Montagu's harrier. Wild birds that may be killed or taken outside the close season include capercaillie, coot, moorhen, golden and grey plover, common and jack snipe, 10 species of duck, four species of geese, and woodcock. The cuckoo, chaffinch, lark, and owl are among 61 birds that may not be sold alive.

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Questions

Meat Inspection

Mr. Peter Freeman (November 12th) asked the Minister of Agriculture whether his attention has been called to a speech made at Aberdeen recently by a superintending veterinary officer of the Ministry of Agriculture in his official capacity recommending that the inspection of meat should only be done by members of the veterinary profession, in view of the large proportion of disease among animals; whether this proposal was made with his approval; and whether he will consult with the Minister of Food with a view to its adoption.

Sir T. Dugdale: The speech to which the hon. Member refers was made by a superintending veterinary officer of my Department in his capacity as President of the British Veterinary Association and not in his official capacity and my approval was not sought. I have consulted my right hon. and gallant Friend the Minister of Food and understand that he is satisfied that the present arrangements for meat inspection are adequate to ensure that diseased meat is not sold for human consumption.

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Myxomatosis

Major Anstruther-Gray (November 10th) asked the Secretary of State for Scotland how far the disease of myxomatosis has been reported among rabbits in Scotland; to what extent this disease is confined to wild rabbits; and what is the policy of his Department in the matter.

Mr. J. Stuart: I have received no reports of outbreaks of this disease in Scotland, but the North of Scotland College of Agriculture are conducting experiments with the virus on a few small islands. I understand that myxomatosis may affect domestic rabbits and, perhaps, hares as well as wild rabbits. My right hon. Friend the Minister of Agriculture and I have set up a Committee under the chairmanship of Lord Carrington to advise us on this matter.

Mr. Hastings: Is the Minister convinced that this disease can be confined to an island and will not spread to the mainland?

Mr. Stuart: That is the advice which I have received. I think that that is the case. I hope so.

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Mr. E. Wakefield (November 12th) asked the Minister of Agriculture what steps he is taking to control the spread of myxomatosis.

Mr. E. L. Mallalieu asked the Minister of Agriculture why he is spending money and effort on the wiring-in of those warrens in the county of Kent wherein the rabbits are infected with myxomatosis.

Sir T. Dugdale: It cannot be taken for granted that, because wild rabbits are a pest and myxomatosis destroys them, we should allow the disease to spread from the initial outbreaks in this country. Its effectiveness might well diminish in course of time; but its disadvantages would remain. We cannot lightly accept the establishment of a new virus disease; nor can we disregard the humanitarian aspect. The disease affects domestic as well as wild rabbits.

As I announced in the House on October 29th, the Secretary of State for Scotland and I have appointed a committee to advise us on the problems raised by the disease, and in the meantime my Department is making every effort to contain and destroy rabbits in the three known centres of infection. The committee is in full agreement with the action so far taken.

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Slaughter of Horses

Lieut.-Colonel Bromley-Davenport (November 10th) asked the Minister of Food what steps are being taken to ensure that all the Departments concerned with the recommendations of the Report of the Committee of Inquiry into the Slaughter of Horses are co-operating so as to ensure that these recommendations are implemented at the earliest possible opportunity; whether legislation will be introduced by Her Majesty's Government on this subject during the current session; and whether he will give an assurance that Government support and assistance will be given to any Private Member who may himself introduce an unofficial Public Bill for this purpose.

Dr. Hill: The views of the Departments concerned are being co-ordinated by my Department and my right hon. and gallant Friend hopes shortly to make a statement of the Government's intentions. It would be premature at this stage for me to express any view of the Government's attitude towards any Private Member's Bill on the subject that might be introduced.

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Caponised Cockerels

Lieut.-Colonel Bromley-Davenport (November 9th) asked the Minister of Agriculture what advice he has received from his scientific advisers with regard to the present-day methods of caponising cockerels; what severe changes result in birds so treated; and what steps have been taken to ascertain what are the consequences of the heads, necks and offal of such birds being consumed in large quantities by pigs.

Mr. Nugent: My right hon. Friend is advised that the chemical caponisation of cockerels by means of synthetic female sex hormones is a satisfactory method of producing good quality table poultry. The effect of the treatment is to arrest the development of the male characteristics of the bird. It is recommended that the treatment should be discontinued a fortnight before slaughter, and that waste products and offals of birds that have been subjected to this treatment should not be fed to any class of livestock including pigs. This advice is based on an assessment by our scientific advisers of the results of investigations in the United States. There have been, so far as I know, no such investigations in this country.

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Imbra Rabbit Trap

Mr. M. Lindsay (November 12th) asked the Minister of Agriculture how long the field trials of the Imbra humane rabbit trap are expected to take.

Mr. Peter Freeman asked the Minister of Agriculture what progress has been made in his tests of the new trap for the destruction of rabbits; and when it will be introduced on a wholesale scale.

Sir T. Dugdale: Full-scale tests only started after the harvest and it would be premature to draw any conclusions at this stage. As I said in reply to my hon. Friend the Member for Aylesbury (Mr. Summers) on June 25th, I hope to have useful results by the beginning of next year.

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Gin Trap (Use)

Mr. J. Johnson (November 12th) asked the Minister of Agriculture when he proposes to introduce legislation for the abolition of the use of the gin trap.

Sir T. Dugdale: Prohibition of the use of the gin trap is under active consideration in conjunction with other proposals relating to the destruction of pests, but I am not yet in a position to make any announcement on the subject.

ROYAL COLLEGE OF VETERINARY SURGEONS

Animal Management Examination, November, 1953

List of Successful Candidates

Edinburgh

Beech, J. A.
Brunton, A. S.
Cameron, D. C. K.
Easingwood, D. E.
Hartley, E. G.
Penman, Gordon (C)
Prior, J. G.
Singh, Arimardan
Stone, N. W.

Dublin

Bransfield, V. J.
Doyle, I. McL.
Fogarty, W. P.
Lydon, C. T. (C)
Moloney, J. B.
O'Donnell, L. I.
O'Neill, J. J.
Quirke, S. S.
Ryan, N. A.
Schlesinger, Percy

London

Abrams, J. T.
Cook, W. E. R.
Cullinane, J. A.
Davies, Miss G. M.
Howse, J. N.
Hudson, M. R.
Kinnear, C. S.
Marrable, A. W.
Prasad, A. K.
Townsend, Miles

(C) denotes credit (C) denotes credit

Pharmacology Examination, November, 1953

London

Baxter, C. J.
Bedson, I. F.
Bowles, Jeffrey
Cameron, R. S.
Coryn, H. D.
Derbyshire, J. B.
Dier, B. G. F.
Down, B. C.
Evans, E. D.
Fairhall, D. C.
Fenton, B. K.
Finn, C. A.
Gray, John
Heptinstall, Jack
Hudson, J. R.
Hyde, Miss K. B.
Kerry, J. B.
Lifton, J. M.
Markham, Keith
Millar, J. A.
Morath, D. E.
Naylor, D. C.
Owen, Geoffrey
Parkinson, K. D.
Pocock, E. W.
Prole, J. H. B.
Rawson-Shaw, Miss E. A.
Shrimpton, D. F.
Stevens, H. R.
Taylor, E. L. G.
Thorp, A. C. B.
Wall, L. J. T.
Ward, Anthony
Whitaker, D. L.
White, Frederick
Wilson, Miss E. D.
Woollett, W. G. W. A.

Dublin

Cawdery, M. J. H.
Carroll, Miss U. P. J.
Clarke, J. P.
Harris, Miss M. D.
Hartigan, P. J.
Kent, D. K.
Nolan, J. J.
Stack, P. D. J.
Wilson, D. J.
York, A. J.

Private Member's Bill on Humane Slaughter

As we go to Press it is announced that Mr. Arthur Moyle, M.P., is to bring in a Bill to ensure the provision of more humane conditions when horses and other animals are sold for slaughter. He drew first place in the ballot last week for private members' Bills.

The Bill will stipulate that there shall be adequate resting place and food before slaughtering, which must be done in humane ways and not in sight of other animals. It will amend the principal Act concerned with this subject and its proposals will cover horses and other farm animals, including cattle, sheep, and pigs.

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In view of the importance and wide public interest in clean food and food equipment, the Council of the Royal Sanitary Institute have instituted a Standing Committee on the Hygiene of Food and Food Equipment. The work of this committee will be the correlation, development and co-ordination of work on the hygiene of food and food equipment with special reference to the formulation of functional specifications related thereto.

NOTES AND NEWS

Diary of Events

Nov. 25th.—Meeting of the Scottish Branch, B.V.A., in the Royal (Dick) School of Veterinary Studies, Edinburgh, 2.30 p.m.

Nov. 25th.—Meeting of the Lancashire Division, B.V.A., in the Lecture Theatre of the Geology Department, University of Liverpool, 2.15 p.m.

Nov. 25th.—Meeting of the Southern Counties Division, B.V.A., at Salisbury (Cathedral Hotel), 6.30 p.m.

Nov. 27th.—Meeting of the Society for the Study of Animal Breeding at the Wellcome Research Institute, Euston Road, N.W.1, 2.15 p.m.

Nov. 27th.—Annual General Meeting of the North Wales Division, B.V.A., in the Council Chambers, Ruthin, 2 p.m.

Nov. 27th.—Meeting of the Royal Counties Division, B.V.A., at Reading (Caversham Bridge Hotel), 2.30 p.m.

Dec. 4th.—Annual Dinner and Dance of the North Wales Division at Llandudno (St. George's Hotel), 7 p.m. for 7.30 p.m.

Dec. 10th.—Meeting of the Essex Veterinary Society, at the Essex Institute of Agriculture, Writtle, 7.30 p.m.

Dec. 16th.—Meeting of the Section of Comparative Medicine, Royal Society of Medicine, to be held jointly with the Section of Ophthalmology, at 1, Wimpole Street, W.1, 5 p.m.

Dec. 17th.—Annual Dance, Dumfries and Galloway Branch of the V.Y.B.F. Ladies' Guild, at the Cairndale Hotel, Dumfries.

Dec. 18th.—Meeting of the Midland Counties Division, B.V.A., at the Birmingham Medical Institute.

B.V.A. Committee Meetings

The following are the arrangements for the next meetings which will be held in London on Thursday and Friday, November 26th and 27th, 1953:—

Thursday, November 26th

11.0 a.m. Meeting of Sub-committee *re* Calf Husbandry and Diseases.

Friday, November 27th

10.30 a.m. Meeting of Technical Development Committee.

R.C.V.S. Membership Examinations

Dec. 10th.—M.R.C.V.S. Written Examinations.
Dec. 11th.—M.R.C.V.S. Written Examinations.
Dec. 14th.—M.R.C.V.S. Oral and Practicals commence (Panels "A" and "B").

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Change of Date of Next Meetings of Council and Committees B.V.A.

Owing to the fact that headquarters will be moving to 7, Mansfield Street just before Christmas the meetings fixed for early January (6th, 7th and 8th) have now been postponed until Wednesday, Thursday and Friday, January 20th, 21st and 22nd, 1954.

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Protection of Animals (Amendment) Bill

LADY DAVIDSON TO PRESENT AS PRIVATE MEMBER

We are pleased to be able to inform our readers that Viscountess Davidson, who had the good fortune to secure second place in the ballot for the presentation of Private Members' Bills on the Fridays allotted to them during the present session, has given notice of this intention in connection with the first Bill to be sponsored by the British Veterinary Association, that, as it is now worded, "to repeal the Animals (Anaesthetics) Act, 1919, and to extend the provisions of the Protection of Animals Acts, 1911 to 1933, in relation to the performance of operations on animals."

It will be recalled that on the occasion of the Second Reading of the original Bill, secured with support of all parties in the House of Lords on the motion of Lord Stamp (*Vet. Rec.* **65.** 800), Lord Carrington on behalf of the Government expressed full sympathy with the principle of the Bill and the majority of its proposals, but indicated clearly that the prospects of further advancement were dependent upon the activities of the Private Member. The Association and others interested in the Bill are to be congratulated on their new champion to shoulder in the Commons the responsibilities so readily and ably undertaken by Lord Stamp "in another place"; also on the early opportunity now likely to be afforded for the continued consideration of the Bill and—as we may hope with some confidence—its uninterrupted progress through Parliament.

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Food and Drugs Amendment Bill

WIDER REGISTRATION OF PREMISES AND POWER TO CONTROL FOOD INGREDIENTS

The Food and Drugs Amendment Bill, which was introduced into the House of Lords on Tuesday of last week and read the first time, amends the Food and Drugs Act, 1938, and the Food and Drugs (Milk, Dairies and Artificial Cream) Act, 1950. Its main objects are to revise the provisions for protecting the public against the sale of food containing injurious ingredients, and against the misdescription of food and drugs in labels and advertisements; also to provide fuller powers to secure that food is not contaminated in the course of preparation, distribution and sale.

Powers to register all premises where food is sold or handled are amongst the most important in the Bill: under existing legislation the only premises which may be required to register are those where ice cream, sausages and preserved foods are dealt with. The Bill (Clauses 7 and 8) gives the Minister of Food power to require the registration of a wide range of premises, including butchers' shops and public-houses, and the licensing of barrows and stalls. It is intended that the registration shall be administered by local authorities, and that standards of hygiene laid down in regulations by the Minister of Food for the construction, equipment and cleanliness of various types of premises will be the criteria by which acceptance, refusal or withdrawal of registrations will be decided. The first step will be the issue by the Ministry, trade by trade, of regulations dealing with different kinds of premises and the problems caused by different types of food. Registration will follow, in the first instance, of premises dealing with those kinds of food which are considered to be the principal source of food poisoning. Cooked meat which has been stored for some time before being offered to the public is an example. Orders requiring registration will have to be approved by both Houses of Parliament.

The requirements laid down by the hygiene regulations will, it is understood, deal with such matters as types of floor and wall, lighting and ventilation, the provision of sanitary conveniences and their situation. There will be an interim period after the regulations have been made to permit the food trade to achieve the new standards.

Earlier clauses seek to prevent the use of substances in the manufacture of food which might, if taken over a long period, be injurious to health. The Minister proposes to take powers to require information to be supplied by manufacturers about the substances they are using, and, if he thinks it necessary, he can lay down by regulation that certain substances shall not be used at all, or shall only be used under a certain strength. The Minister will also have power to control processes which, although using otherwise innocuous substances, might lead to injury to health.

The Bill (Clause 10) empowers the Ministers of Agriculture, Food, and Health to regulate the composition of milk sold under specified descriptions, to prohibit the sale of milk from cattle in markets and shows, to require such milk to be stained for purposes of identification, and to provide for the temporary registration of dairies and dairymen. Clause 20 confers powers to take samples of milk on inspectors of the Minister of Food, and, in certain cases, on authorised officers of the Minister of Agriculture and Fisheries; it also confers powers of entry on such inspectors and officers in cases where a sample of milk is to be taken and where the Ministers have enforcement powers. Port health authorities and food and drug authorities are empowered to restrict the movement of imported food, and to obtain the name and address of the persons to whom the food is consigned. Government establishments at present enjoy immunity from the provisions of the 1938 Act, unless regulations are made to the contrary, but the new Bill removes that immunity. Other powers will enable the disposal of meat unfit for human consumption to be more effectively controlled.

The Bill amends to a large extent the 1938 Act. It has been felt for some time that this Act is out of date, partly because of the great increase of the number of people eating in restaurants and canteens, and partly because of the development of the processes and new substances in the manufacture of food.

PENALTIES

The maximum penalties under the Bill are £100 or three months' imprisonment—or both—for a first offence, and for a continuing offence, a further £5 for each day during which the offence continues after conviction. Under the 1938 Food and Drugs Act the penalties were £20 for a first offence, and £100 or three months for a second offence. There is a right of appeal to the local authority against the withdrawal or refusal of registrations and the occupier of the premises may be legally represented.

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Australian Research Appointment

The Commonwealth Scientific and Industrial Research Organisation is inviting applications for appointment to the position of Chief of the Division of Animal Health and Production. He will be responsible for the research activities of the C.S.I.R.O. in the fields of animal physiology, animal breeding, bacteriology, pathology and parasitology. He will have general supervision and co-ordination of the Division's investigations and opportunity to develop his own research interests. Dependent on qualifications and experience commencing salary will be within the range £A.2,482—£A.2,606 p.a. nominal (£A.2,680—£A.2,804 p.a. actual) the latter including cost of living adjustment. Fuller particulars can be obtained from the Chief Scientific Liaison Officer, Australian Scientific Liaison Office, Africa House, Kingsway, London, W.C.2, and applications for the post have to be in his hands by December 12th.

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PERSONAL

Appointments.—The following appointments in the Colonial Veterinary Service are announced: Mr. J. W. Macaulay, B.SC., M.R.C.V.S., D.V.S.M., Senior Veterinary Research Officer, Kenya, to be Chief Veterinary Research Officer, Kenya; Mr. R. N. Sanders, B.V.SC., Senior Veterinary Officer, Uganda, to be Deputy Director of Veterinary Services and Animal Industry, Uganda.

Mr. R. L. Chandler's Ph.D. Degree.—Mr. Richard Lionel Chandler, B.SC. (LOND.), M.R.C.V.S., has been awarded the degree of Ph.D. (Lond.) for a thesis entitled "Researches on Chemotherapy and on Breed-tolerance in Bovine Trypanosomiasis in Northern Nigeria." The work was carried out while working at the West African Institute for Trypanosomiasis Research, Vom, Nigeria.

Birth.—BETTY.—On November 12th, 1953, at Musgrove Hospital, Taunton, to Kathleen, wife of Ronald W. Betty, M.R.C.V.S., a son (Michael John), a brother for George.

Forthcoming Marriage.—BROWN—DOLPHIN.—The engagement is announced between Frederick Brown, B.A., M.R.C.V.S., only son of Mr. and Mrs. P. Brown, of Walkden, Lancs, and Sylvia Dolphin, M.S.R., only daughter of Mr. and Mrs. T. C. Dolphin, of Ilkley, Yorks.

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R.C.V.S. OBITUARY

BRYANS, Cecil Hamilton, M.R.C.V.S., c/o Union Bank of Australia, Pitt Street, Sydney, N.S.W., Australia. Graduated Dublin, December 14th, 1910. Died December 18th, 1953.

HUGHES, William, M.R.C.V.S., Grove House, Caerwys, nr. Mold, Flints. Graduated N. Edinburgh, May 22nd, 1894. Died November 11th, 1953; aged 81 years.

XUM

Macqueen, James Miller, M.R.C.V.S., A.R.San.I., of 48, Baker Street, Potters Bar, Middlesex. Graduated London, July 4th, 1948. Died November 15th, 1953.

Taylor, James Turnbull, M.R.C.V.S., Divisional Veterinary Officer, Animal Health Division, Ministry of Agriculture, Elmbridge Court, Gloucester. Graduated Glasgow, July 21st, 1923. Died November 10th, 1953.

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S.V.R. OBITUARY

Nightingale, Ernest, Veterinary Practitioner, of 176, Harwood Street, Darwen. Registered October 16th, 1950. Died November 9th, 1953; aged 75 years.

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Mr. William Hughes, M.R.C.V.S., of Caerwys

An Appreciation

Mr. W. T. Rowlands, Hon. Secretary of the North Wales Division B.V.A., writes:—

"Mr. Hughes died suddenly, in full harness. He was a faithful member of the North Wales Division ever since its inception in 1900, and even at his advanced age was a fairly regular attender at its meetings. He qualified in Edinburgh in 1894 and had a very large and busy practice in Caerwys, being particularly expert in horse practice. In this particular, his services were widely sought after.

"A most energetic and excellent practitioner, a thorough gentleman and a character few of which remain to-day, he will be sadly missed by the farming community and the veterinary profession alike. He is survived by his widow, who is over 90 years old; his son, Mr. T. W. Hughes, M.R.C.V.S., who practices in nearby Mold, and has many of his father's qualities—a keen and expert horseman and sound practitioner—and a daughter."

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Mr. James M. Macqueen, M.R.C.V.S., A.R.San.I.

Mr. James Miller Macqueen, whose death we announce with much regret, was the only son of the late Professor James Macqueen, F.R.C.V.S., of the London College.

Mr. Macqueen, who saw service in France with the London Scottish towards the end of the 1914-18 war, was gassed and wounded. On his discharge from the Army he went to Canada and then to Southern Rhodesia where he was for many years in the veterinary department there. On the death of his father he came home, acquired his diploma as a veterinary surgeon and opened a practice in Potters Bar. He leaves a widow and two daughters, also the sister, Betty, with whom deep sympathy is felt in their bereavement.

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The Late Mr. Jas. T. Taylor, M.R.C.V.S.

Personal Tributes

F. J. H. writes: The death of Jas. Taylor recorded in this issue has caused great sorrow to his many friends in the profession and his colleagues in the Animal Health Division of the Ministry.

He was educated at Morrison's Academy, Crieff, and after service in the 1914-18 war he qualified from Glasgow in 1923. After practising in Winsford and Middlewich, Cheshire, he became a whole-time veterinary officer with Cheshire County Council in 1933, and in 1935 was appointed County Veterinary Officer with Gloucestershire County Council, whilst in 1938 he became Divisional Veterinary Officer of the Ministry for that county.

During his 18 years in Gloucester, no officer could have been held in higher esteem by his staff, the farming community and the various bodies associated with agriculture. It was my privilege to have worked with him and enjoyed his friendship for many years, and no one had a more cheerful disposition, ready wit or kindly patience. Even towards the end of his distressing illness his sense of humour never deserted him. Those of us who have been associated with him know how he loved his work and how ably and tactfully he carried out his duties.

He was extremely devoted to his family and our deepest sympathy in this sad hour is extended to Mrs. Taylor and their four sons; Alan, who is also a member of our profession, Kennedy, Ian and Robert.

The funeral service was held at St. Catherine's Church, Gloucester, on Friday, November 13th, and the attendance was evidence of the high regard in which he was held. In addition to the family mourners and friends, the Animal Health Division was represented by Messrs. J. Cameron,* R. S. Kyle, H. E. C. Ham (also representing W. Scott), G. C. McLaren, C. G. Strachan and F. J. Hill.

Amongst other members present were: Messrs. J. L. Brain, R. L. Cox, M. L. Dartnall, F. J. Eardley, J. P. Frappell, A. W. McLeod, T. J. Margarson, R. P. Morgan, J. G. Murray, W. R. Watson and D. W. Wood.

* Also representing the Association of Veterinary Inspectors.

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T. J. M. writes: Veterinary and agricultural Gloucestershire has lost a greatly loved friend and adviser. A direct man, Jim Taylor did his duty and expected others to follow his example.

Yet however big the problem or hard the work to be done, when J. T. T. had finished with it one wondered: had there been a problem? Because he was one of those men who got things done—thoroughly—but without fuss.

He was essentially a family man—his wife and four sons were his life. When he rang me one night to tell me that his son Alan was an M.R.C.V.S. the phone nearly burst with pride!

A great friend of us all in Gloucestershire has left too soon.

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NORTH OF IRELAND ASSOCIATION VETERINARY BALL

Mr. J. K. L. Pearson, the Secretary of the North of Ireland Division, B.V.A. writes:—

"A most successful dance was held by the above Association on Friday, November 13th, at the Grand Central Hotel, Belfast. Over 300 members and guests were present at the invitation of the President, Mr. S. R. Bolton, and his Committee and it was the biggest social gathering of the Division ever held.

With the 1955 congress in view an effort is already being made to collect funds for the occasion and it is hoped that a profit on the dance alone will amount to about £50. In addition a Congress Ballot had been organised on behalf of both the Congress and the Victoria Veterinary Benevolent Fund. This realised nearly a further £100, which will be equally shared by the Benevolent Fund and that of the future Congress.

The North of Ireland Council take this opportunity once more to thank every individual who contributed so generously to the success of the evening and supported the efforts of the organising Sub-committee.

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ADDRESSES OF DISEASE-INFECTED PREMISES

The list given below indicates, first, the county in which are situated the premises on which disease has been confirmed, followed by the postal address and date of outbreak.

Anthrax:

Ches.—Wheatsheaf Inn, North Rode, Congleton; White Hall Farm, Wheelock, Sandbach (Nov. 11).
Renfrew.—Flatterton Farm, Inverkip, Greenock (Nov. 11).
Salop.—Ivy End Farm, Halfway House, Shrewsbury (Nov. 10).
Warwicks.—Billesley Manor Farm, Billesley, Alcester (Nov. 10).
Wigtown.—Craigenquarrock Farm, Stranraer (Nov. 11).

Foot-and-Mouth Disease:

Glamorgan.—Hargrove Farm, Laleston, Bridgend; Ty Coch Farm, Pyle; Llanmihangel Farm, Pyle, Bridgend (Nov. 12).
Sussex.—Church Wood Farm, Goteley, Northiam, Rye (Nov. 12).

Fowl Pest:

Essex.—Barratts Hall, Great Maplestead, Halstead (Nov. 11); Little Bardfield Hall, Little Bardfield, Braintree (Nov. 12).
Hants.—Newtown, Awbridge, Romsey (Nov. 11).
Norfolk.—Redroofs, King Row, Shipdham, Thetford (Nov. 11); Orchard Farm, Tibenham; The Heath, Horsford, Norwich (Nov. 12).
Notts.—Woodbine Cottage, Granby (Nov. 11).

Swine Fever:

Ches.—High Street, Farndon, Chester (Nov. 12).

Dorset.—Rectory Farm, Winterbourne Zelstone, Blandford, Nr. Wimborne (Nov. 11).

Glamorgan.—Ynysygerwn Farm, Aberdulais, Neath (Nov. 12).

Herts.—Wrights Farm, Pirton, Hitchin (Nov. 14).

Kent.—Little Reeds Farm, The Alders, Capel Tonbridge, Tonbridge (Nov. 11).

Lancs.—The Piggeries, off Lovers Lane, Atherton, Manchester, Lancs (Nov. 14).

Lincs.—Burgh Road, Skegness (Nov. 12).

Norfolk.—The Poplars, Boughton, King's Lynn (Nov. 12).

Sussex.—Newhill Farm, Barnes Green Road, Billinghurst (Nov. 11).

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TRICHINOSIS IN LIVERPOOL

Perhaps as a trenchant commentary on the warning given by D. J. Anthony in the correspondence columns of our issue of September 12th, comes the announcement that to date, 24 cases of trichinosis have been discovered in Liverpool. The Medical Officer of Health has emphasised that no one in the city should eat pork unless it had been thoroughly cooked and on no account should uncooked sausage meat be eaten. " The disease is mild in type and causes puffiness of the eyelids and rheumatic muscular pains with some temperature. There is no cause for alarm and it is likely that the outbreak will not be of long duration," he added. A consignment of infected pork is suspected to be the cause of the outbreak.

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U.S. FULBRIGHT TRAVEL GRANTS, 1954-55

The United States Educational Commission in the United Kingdom announces that, under the provisions of the Fulbright Programme, travel grants are available to citizens of the United Kingdom and Colonies to go to America for an academic or educational purpose, such as study, research, lecturing or the pursuance of other educational activities. All awards are competitive.

The basic criteria for the award of a travel grant are as follows:—

(*a*) Applicants must hold a University degree or recognised professional qualification prior to actual departure.

(*b*) Applicants must possess a guarantee of financial support in dollars for the proposed period of the visit to America.

(*c*) Graduate students must show proof of admission to an American institution of higher learning. All applicants, whatever their programme in America, must be definitely affiliated with such an institution. In the case of medical internships, the hospital to which the applicant hopes to go must be acceptable to the registration body.

(*d*) The minimum period of study in the United States for graduate students is nine months. Professors, lecturers and senior research workers must intend to spend at least three months in the United States (exclusive of trans-Atlantic travel time), of which about two-thirds should be spent at one university or recognised research institution. Grants cannot be given for attendance at conferences alone, nor can awards be extended beyond a second year. All candidates are expected to return to reside permanently in the United Kingdom or Colonies.

(*e*) All applicants must be citizens of the United Kingdom or Colonies.

(*f*) Four years must elapse from the date of return from America before a second application may be made for a Fulbright travel grant.

These travel grants are available for travel to America between June 1st, 1954, and April 1st, 1955. All travel grants cover the cost of direct travel between a candidate's home in the United Kingdom or Colonies and the destination in America. No allowances are made for dependants' travel. Since the funds of the Commission are in non-convertible sterling, it is not possible to offer grants for maintenance, tuition or incidental expenses within the United States.

There are two closing dates dependent on the departure date. They are: *March 15th*, 1954, for those travelling between June 1st and July 31st, 1954; *June 1st*, 1954, for those travelling after August 1st, 1954. No applications can be considered after the closing dates.

Those wishing to apply are first asked to fill up a record card. This in itself does not constitute an application. Full-length application forms are sent only when candidates indicate that their plans are complete, but this must be before the appropriate closing date. Record cards and application forms may be obtained from: United States Educational Commission in the United Kingdom, 55, Upper Brook Street, London, W.1.

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Virus Pneumonia of Pigs

It is now well established that virus pneumonia is the cause of considerable economic loss to pig keepers. This loss arises partly from the occurrence of clinical cases of pneumonia—which are often associated with secondary bacterial infection—but, more especially, from the retardation of growth and poorer utilisation of food which are shown by infected pigs. The presence of virus pneumonia also complicates the interpretation of pig feed trials, progeny tests, etc.

Virus pneumonia of pigs was the chief subject of the talk which Dr. Alan O. Betts gave in Bedford on November 11th at a meeting arranged by the Bedfordshire A.E.C. Dr. Betts mentioned that it had not yet been possible to develop a diagnostic serological or skin test, but that carrier sows could be detected by farrowing them down in isolation, the presence of coughing in the young piglets indicating that the dam was infected. He said that this was the basis of a method of eradication which was at present the subject of a field trial and that this was giving encouraging results.

Several other pig diseases were discussed more briefly. The number of questions asked by the audience showed that the talk had been keenly appreciated.

E. A. G.

CORRESPONDENCE

The views expressed in letters addressed to the Editor represent the personal opinions of the writer only and their publication does not imply endorsement by the B.V.A.

SYMPTOMATOLOGY IN DISORDERS OF THE SPLEEN

Sir,—The last paragraph of Mr. Coward's letter regarding " haemorrhagic splenic cyst in a dog " prompts me to enquire if anyone can explain why conditions of this organ which appear to be identical produce such a variation in symptoms?

The last four cases of splenic enlargement (one established histologically as a haemangioma and the others microscopically identical) have given rise to: Case I—Lassitude and anorexia; Case II—Persistent diarrhoea; Case III—Persistent constipation; Case IV—Vague " illness " with gross " anaemia " followed by multiple haemorrhages reminiscent of " Warfarin " poisoning after splenectomy.

In all cases there has been no other lesion noticeable on laparotomy, and in the last case on *post-mortem* examination.—Yours faithfully, Peter J. Dalton, Old Sarum House, Stratford Road, Salisbury. *November 9th*, 1953.

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CANINE DISTEMPER PROPHYLAXIS

Sir,—I am much interested in an advertisement in *The Veterinary Record* for September 12th, 1953, of an egg-adapted distemper vaccine.

As you perhaps know, such vaccine has been available in the United States for the past two years at least. Since the prophylactic value of the egg-adapted vaccine is undoubtedly debatable, I am more than a little surprised to see that the manufacturer states that it " is a good therapeutic agent in the treatment of both infections " (canine distemper and hard pad).

Has there been any published evidence to prove this point?—Yours faithfully, Gerry B. Schnelle, V.M.D., Chief of Staff, The Angell Memorial Animal Hospital, 180, Longwood Avenue, Boston 15, Mass. *October 27th*, 1953.

TRUE "LOCKED JAW"

Sir,—*Re* the case of true "locked jaw" reported in to-day's *Veterinary Record*, I have seen two similar cases in the past 12 months. The subject in the first case was a wire-haired terrier which had been in the habit of carrying a newspaper for its owner. On reaching home one day it was unable to release the paper. Paper was wedged between all the incisor and canine teeth and had to be pushed out with a tooth scaler. It was not until the last tiny piece had been removed that the dog was able to open its mouth. The cause in this case appeared to be an absolutely perfect set of teeth!

The second case was in a mongrel terrier which had been playing with corrugated cardboard, with a similar result. In this case the patient showed both his gratitude and the fact that he could open his mouth by snapping at all concerned as soon as the cardboard was removed!—Yours faithfully, Arthur G. Welch, National Canine Defence League, 4, Robertson Road, Brighton, 5, Sussex. *November 13th*, 1953.

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OUTSIZE CALVES

Sir,—It may be of interest to Mr. John Buchanan, of Dorchester, Dorset, that I calved a Friesian cow which had gone over her time a month and a day. The calf was born dead. Twenty-four hours later it was weighed at the Whaddon Chase Kennels and went 167½ lb.—Yours faithfully, Wm. A. Gibb, Market Square, Leighton Buzzard. *November 14th*, 1953.

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THE VETERINARY ASSISTANT PROBLEM

Sir,—I class myself as an ordinary practising veterinary surgeon trying to run a normal type of practice. Some months ago I joined my 35 to 40 colleagues who advertise week by week in *The Veterinary Record* in search of assistants. After a period I received one reply and fixed up a trial period with the applicant who turned out to be another of the quite unemployable persons who thrive under present-day conditions. Like some of my neighbours I have given up advertising and I now work all day and every day but still feel I am not giving the service that might be given.

I should be interested to hear if there are others in the same plight and what their opinions are regarding the idea of making newly qualified veterinary surgeons waste two years in the armed forces where they forget most of what they knew and only learn to waste time. It is a waste of time, because if war broke out again they would have to be rushed immediately into practice to save the loss that is going on to-day owing to the lack of veterinary attention.—Yours faithfully, A. V. B. Foster, Yew Tree House, Knowle. *November 9th*, 1953.

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MEAT INSPECTION SERVICES

Sir,—Mr. J. M. Olivant's reply (*Vet. Rec.*, November 7th, 1953) to my letter is rational, just and most constructive in its nature and affords one the opportunity to stimulate discussion and to open up the whole question of meat inspection services and the ever-important subject of meat hygiene.

He states "the faults of the present meat inspection services are both technical and administrative" and goes on to refer to the gross deficiencies in legislation, total lack of application of the principles of meat hygiene, lack of real authority to enforce the hygienic slaughtering, handling and transport of meat and meat products, and to the paucity of laboratory facilities to assist the meat inspector in his work. These charges are true.

Meat, as an important and essential article of diet, enters almost every home and is eaten by the vast majority of the population. It can be compared as an equal to milk in its wide distribution and use. We have heard so much about clean milk production, but, in comparison, so little about clean meat production. There have been bacteriological standards set for milk, but none for meat. Why this nauseating apathy? Is it because the production of clean meat is thought to cost more both in money and effort? I do not think so. I believe it is due to the general lack of interest and to the presence of ignorance all along the production line from the farmers, dealers, contractors, slaughtermen, butchers, to the general public as well. Amongst these the slaughterman is the outstanding offender. One of the root causes of bad meat hygiene lies in the trade practice of paying the slaughterman "head-rates," which encourages increased throughput, but inevitably discourages any high, or even normal, standards of meat hygiene. It would be a step in the right direction if the issue of slaughtermen's licences were made conditional on their ability to observe and practise the elementary principles of clean food production.

I agree that Memo 3 Meat does violence to the intelligence of any public health worker, and, in itself, reflects in no small degree this general state of apathy. We have seen during the last few years *Cysticercus bovis* steadily spread its malignancy over the country and now there is the ever-increasing possibility of *Trichinella spiralis* enjoying the same "living-space." One looks in vain for the rigorous measures which should be adopted on a national scale to combat these evils.

Meat inspection has been denied the importance which has always been its rightful due. Local Government has, so far, failed to recognise the meat inspector as a specialist officer. Under-staffing, lack of facilities, and general unsatisfactory working conditions have always been, and still are, prominent deficiencies in the meat inspection services. No establishment standards have been laid down and, consequently, one finds the meat inspectorate grossly overworked and, in numerous cases, physically incapable of carrying out the bare recommendations of Memo 3 Meat. Records and statistical data, which would be of such immense scientific value, are kept, if kept at all, to the absolute minimum, resulting in a grave loss to the nation as a whole.

And what of the future? An opportunity is being presented by the Government's action in setting up a proposed network system of between 300 and 400 abattoirs throughout England and Wales. Concentrated slaughtering under ideal conditions will permit concentrated effort in the field of meat inspection and meat hygiene. Let establishment standards be laid down to ensure the maximum amount of efficiency; let them permit the "integration of the skill and knowledge of the trained scientist and his practical confrère"; and, above all, let them make possible a meat inspection service second to none.—Yours faithfully, J. A. McPherson, "Bournside," Warden Hill Road, Cheltenham. *November 14th*, 1953.

DISEASES OF ANIMALS ACT, 1950—GREAT BRITAIN

Summary of Returns of Confirmed Outbreaks of Scheduled (Notifiable) Diseases

Period	Anthrax	Foot-and-mouth	Fowl Pest	Sheep Scab	Swine Fever
16th to 31st October, 1953 ...	9	1	37	—	84
Corresponding period in—1952	104	—	19	—	20
1951	7	—	43	—	97
1950	13	—	4	2	32
1st January to 31st October, 1953 ...	528	29	790	—	2,436
Corresponding period in—1952	842	494	199	1	743
1951	339	28	653	5	1,122
1950	297	20	107	23	242

Tuberculosis (Attested Herds) Schemes

The number of Attested Herds, i.e., herds officially certified as free from Tuberculosis as at October 31st, 1953, was as follows:—

England	Wales	Scotland	Total (Great Britain)
53,010	28,843	27,505	109,358